Electrical World

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Blue Print or State Paper?

WHEN President Hoover expresses his opinions he leaves little to the imagination. His message to Congress is a logical engineering report on the machinery of government combined with sound recommendations for the improvement of pressing economic and social conditions. The address is long, but it is well worth reading.

He touched upon several topics of interest to the electrical industry. Full-time appointments for the Federal Power Commission are recommended, together with an extension of its regulatory power to cover interstate business in the emergency that joint action by state commissions is not taken. He recommends a special commission to act upon Muscle Shoals and believes its suitable facilities and all revenues should be devoted to agricultural research. The power in large measure should be sold, and the government should not operate a power or a manufacturing plant except as these are byproducts of business devoted to a major public purpose. These suggestions of the President are in line with opinions expressed in the past, and it is to be hoped they will be followed by Congress.

There is little disagreement as to the knowledge and intellectual ability of President Hoover. He is a master of business and of government. But the verdict has not yet been rendered on his political ability. The recommendations he has made depend on Congress for their realization, and only time will tell whether the message shall become a working specification or merely a "great state paper" to be preserved in the archives. Getting the plan adopted is a more difficult task than drawing it up. Business men and engineers can help get favorable Congressional action if they will.

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Criticism of New England Factors Reflects on Power Industry

AT THE invitation of the New England Council a report was presented at the recent conference held under its auspices in Boston giving the impressions of a party of twenty editors of McGraw-Hill industrial publications who had just completed an inspection tour of New England industries. The report made some comments upon the use of electricity that may well receive serious thought from the power companies in the states concerned. The party had visited sixty-eight factories, in forty-one communities, in six states, that had been selected by the New England Council for their prominence in their fields and their importance to communities. They embraced the whole sweep of New England's diversified manufacturing activities.

The report lists both favorable and unfavorable factors and makes some definite recommendations. The following summaries refer to electrical conditions:

Favorable.— Electric power has kept pace with the growth of New England industries and, by the development of both hydro and steam generation and the interconnection of systems, affords as progressive a service as is available in any section of the country and at favorable rates.

Unfavorable.—The lighting of New England factories appeared to us to be distressingly bad, despite a few examples of the most advanced industrial illumination. Great floors of machinery spotted only with dirty lamps in inefficient or improvised reflectors at the tool, supported by no adequate general illumination, is a common condition. With this dark halls and stairways come as a matter of course. It all takes an inevitable toll in accidents, low speed and spoilage of materials.

Recommendations.—That the part played by electrification in the modernization of New England industries be studied. The electric power industry has done a splendid job in providing facilities. It should be asked to co-operate more fully in the promotion of New England progress by taking a more vigorous responsibility in introducing better industrial lighting and those applications of electric power and heat that promote improved economies in manufacturing.

Of course, these particular comments might probably be also made upon the majority of factories in other sections, as the report attested. Taken in its entirety, however, the criticism was impressive, as the testimony of a group of experienced neutral observers familiar with industrial conditions over the country. The stress put upon the failure of manufacturers to seize upon the practical advantages of efficient lighting, individual motor drive and the wider use of electric power for material handling was pointedly made a criticism of the electric power companies also. It is a fair charge against the power industry as a whole.

The old tradition still endures. Power resources are provided. Factories are lighted. Motors are sold. But the average utility executive does not yet accept the responsibility for local industrial progress that his function in power development inescapably entails. For it is not enough to provide for generation, transmission and distribution. There is also a moral obligation on the public service company to educate the public in the use of electricity, which means to "sell" the

manufacturer thoroughly and see that local industries are reaping the benefits of all the practical economies that electrification offers. Since the prosperity of local industries makes the prosperity of the city, the local franchise for electric power supply rightfully demands much more than readiness to serve.

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Hurley Suggests How Industry Can Prevent War

FROM an electrical manufacturer this week comes a practical business man's suggestion to the International Chamber of Commerce, that the leaders of industry be organized for the prevention of war. Edward N. Hurley, long a manufacturer of domestic electric appliances and chairman of the United States Shipping Board during the war, out of his broad interest in international affairs has addressed a communication to President Theunis of the International Chamber. He points out that the ability of the nations to engage in warfare depends today upon the support which comes to their armies from the electrical, metallurgical and chemical industries. He shows that these industries throughout the world are controlled by a very small number of men. He recommends that these few men be formally enlisted to prevent the supply of ten or twelve raw materials without which modern armies cannot take the field.

For ages humanity suffered the pain and fear of war and no man dared to lift his eyes out of the deep ruts of tradition and even hope to put a stop to it. Then came the cataclysm of world war, and millions of young men marched into battle inspired by the ideal that this at last was a war to end war. But the armistice was followed once again by the bickering and threats of politicians, with rumors of wars, new preparations and a universal sense of disillusionment. After all, there seemed to be no hope, despite the infinite price paid. But the innate common sense of civilized man is now beginning to assert itself. The Kellogg treaty has officially outlawed war. A new disarmament conference has been called. And now Mr. Hurley asks why industrial leadership itself should not be organized against the crime of self-destruction by the simple control of that industrial production that makes war possible.

It is not difficult to list the men in America, England, Germany, France and Italy who by the electrical industry could paralyze the fighting forces of all nations by denying them electrical equipment. These men could wield a mighty influence against war if they would speak as one for this essential industry. And so could similar groups who order the production and the sale of steel, copper, coal, chemicals, gasoline, oil and rubber. It is a cause worth any man's leadership and deserving the organized attention of any industry. Mr. Hurley's idea is a challenge to industrial leaders—to electrical men—that should be seized and carried forward.

Some Standardization Needed in Metal Switchgear

THE advent of metal-clad switchgear offers opportunity to see if a goal cannot be set for some degree of standardization and simplification even at this early stage of development. A first proposal is to make definitions.

The term "cubicle," for example, is old, but it has taken on new meanings in recent years. In the past a complete subgroup of masonry switch cells, usually a group of feeders, was frequently designated as a cubicle. But the advent of metal-clad gear also brought adaptation of the same term applied to a very different installation. Three distinct types of metal cells now seem to be definitely established. The first is the truck type, the second is the compound or oil-filled and the third and youngest is the cubicle.

The principal differences between the truck type and the compound or oil-filled cells, on the one hand, and the cubicle, on the other, is that in the first two types the breaker is not solidly mounted or solidly connected to the buses and outgoing cables, but is moved into place in either a horizontal or vertical direction, making contact as it gets into place and thus requiring no "disconnects," whereas in the cubicle the breaker is permanently bolted in place, requiring disconnects to clear it. All of these three types are completely built and assembled in the factory and shipped assembled to the customer.

Both for the purpose of purchase specifications and in order to reach some degree of standardization in equipment it would seem advisable to study metal-clad gear. A great deal of money and trouble will be saved the industry if standardization and simplification are anticipated. Past experiences with the standardization of oil breakers and transformers are sufficient proof that an early start is advantageous.

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Spare-Equipment Policy Should Be Based on Data

HOW much duplicate or spare equipment should be provided in a power house, a substation or a transmission system? For which type of equipment and under which conditions shall complete duplication be provided? When shall one piece of spare equipment be provided per station and when none at all?

These are very important questions, because they seriously affect the cost of energy and the reliability of service. And yet it would be quite difficult to find two engineers or operators to give the same answer in a given case. One man may have had some serious transformer trouble impressed upon his memory, and subconsciously he will favor complete duplication of transformers, whereas he may not insist on duplicate

switching. Another man may have suffered a serious interruption through a switch failure, and he will insist on switch duplication, but will not require duplicate transformers. Thus the past experience or prejudice of an individual may lead to considerable useless expenditures or, at other times, fail to provide necessary spare parts.

In some cases spares are provided for their cheapness. It is customary, for instance, to add a fourth transformer to a bank of three, even when the bank is directly connected to a generator in a station which has no spare generator unit, because a spare transformer costs much less than a spare turbo-generator.

This lack of any definite method or system in providing for spares is due to the lack of statistics which will indicate the extent to which spare equipment has actually prevented interruptions or shortened their duration, or the extent to which spares have made inspection easier and lengthened the life of equipment. It should not be difficult to prepare suitable forms or blanks for gathering the necessary data over a period of years. The data should have been collected long ago. But past neglect is no excuse for continued neglect. Such an investigation should be begun forthwith and prosecuted with seriousness and vigor.

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Undervoltage—a Market Handicap

IT IS unbelievable that in this age of intensive selling a ready market for many million dollars' worth of electrical energy and electrical products should be left almost entirely unexploited. Yet such is the case. Engineers have determined the degree of relationship between undervoltage and the revenue from energy sales, but even now little is done to take advantage of this long-neglected opportunity in a commercial way.

Undervoltage in every class of electric service results in financial loss to all parties concerned. The central station sells less energy, the manufacturers and wholesalers sell fewer lamps and less wiring material, and, last but by no means least, the consumer gets substantially less for his money. For instance, when 10 volts less than marked voltage reaches the lamp socket the revenue drops as much as 13 per cent while the light intensity is reduced by 26 per cent.

Voltage tests, both at the meter and the sockets, will develop how much any condition of undervoltage is due to delivery by the lighting company of voltage at less than its normal value and how much voltage is lost in the customer's wiring. These tests can be made and the regulation can be improved at a profit to the utility. Higher revenue per meter is the central-station company's reward for delivering correct voltage, while increased lamp sales and many thousands of rewiring jobs will reward the electrical contractors and retailers.

It is estimated that twenty-five million dollars' worth of additional lamps and fifty million dollars' worth of additional energy would be sold to domestic customers alone if undervoltage conditions were corrected. In the industrial field another large market awaits the development that will follow improvement of voltage conditions. Obviously, then, here lies an opportunity ready and waiting to provide added sales and increased profits for all groups in the electrical industry, and the ultimate consumer will benefit most because he will get better and more service. The magnitude of the market makes its development imperative.

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Steam Reserve Stations Essential to Hydro Developments

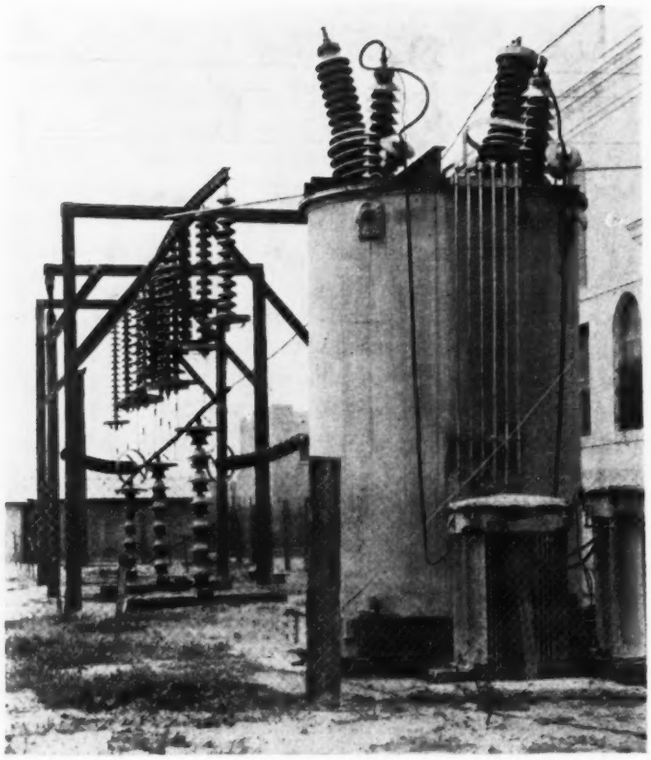
WITHOUT seeking to detract from the value of water power as a natural resource and as an aid to electric public utility development, it would be well for all concerned to take cognizance of the conditions prevailing at present in the Pacific Northwest. There, owing to long-continued drought, the use of electricity in Seattle, Tacoma and elsewhere in western Washington is being curtailed notwithstanding the existence of steam reserve stations. Obviously, the latter are not large enough, and the utilities of Washington find, like those of California found a few years ago, that it is necessary to increase greatly the size of these emergency plants.

Thus we have an interesting sidelight on the instability of water power, for with a few exceptions —like, for example, Niagara Falls—all water-power developments are subject to the same trouble. Unfortunately, legislators, commissioners and a host of others, including the public, who are not intimately associated with the operation of electric light and power systems and the exacting demands for service, do not appreciate this venturesome side of hydro-electric development. Steam stations are subject to other hazards, but for reliability they still bear the palm.

This does not mean that water power should not be developed. Quite the contrary. But it does signify the necessity of standby stations large enough to cope with such emergencies. This necessarily involves greater expense, but what are the few millions invested in reserve stations compared with the assurance of adequate and reliable electric service at all times? Water power is one of this country's most valuable assets, and the electric light and power industry is the greatest exponent and user of it. That it possesses elements of risk is well known to all operators, but so are the means for insuring against such risks. True, it is cheaper to operate hydro-electric plants without reserve stations. However, the public is no longer content with the indiscriminate service obtained from such systems, and the trifling cost of auxiliary stations to guarantee commercially reliable service should not be withheld by the companies or disallowed by the commissions.

The Answer to Spray and Fog Exposure

Insulator Surface Resistance



TESTS conducted by the Southern California Edison Company over a period of more than two years to determine insulator performance at 220 kv. under spray and for conditions near the seashore have led to the following conclusions:

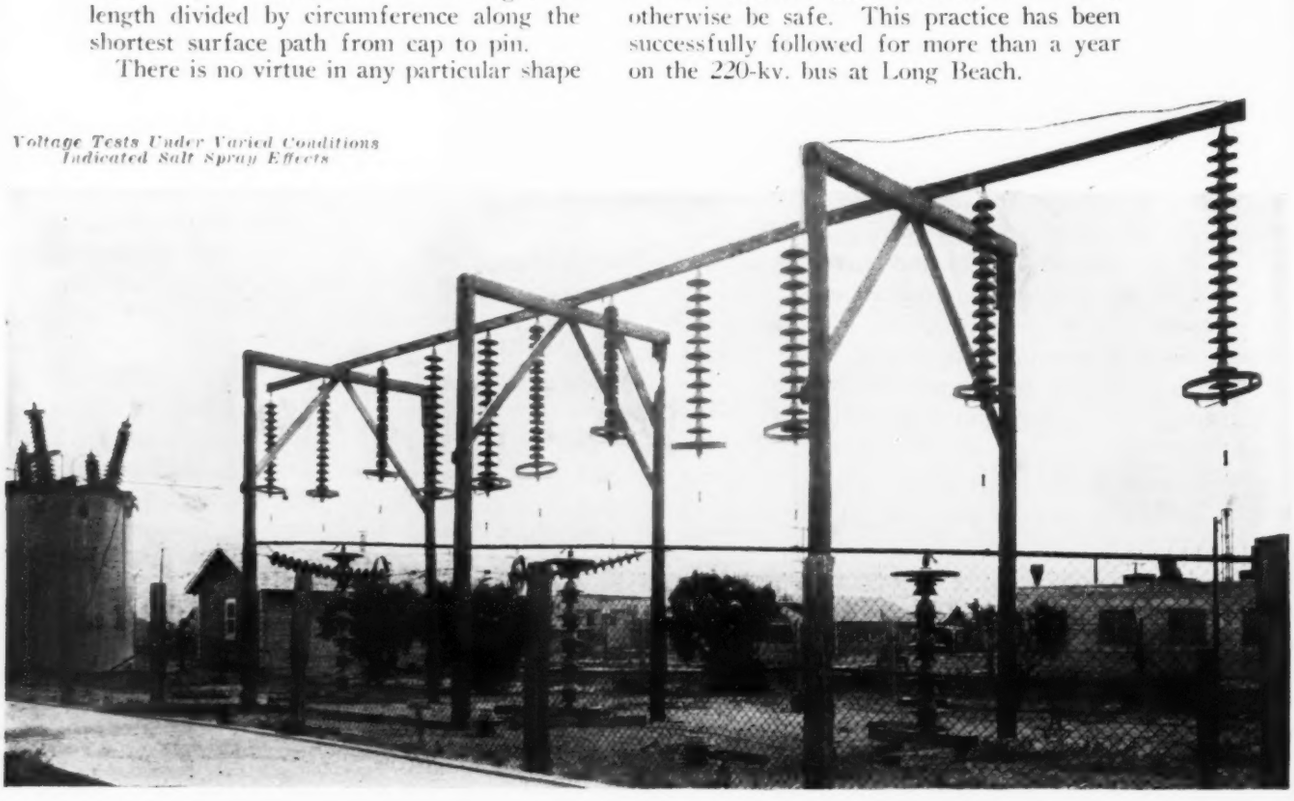
Insulators may be compared as to their ability to withstand arc-over under spray and fog conditions by their surface leakage resistance, calculated as the line integral of length divided by circumference along the shortest surface path from cap to pin.

There is no virtue in any particular shape except as it provides surface leakage resistance.

One insulator string will not consistently arc over in preference to another unless its surface leakage resistance is less than 80 per cent of that of the other.

It has been found practicable to clean some insulators, while energized, with a fresh water spray, thus making possible the use of a smaller number of units than would otherwise be safe. This practice has been successfully followed for more than a year on the 220-kv. bus at Long Beach.

Voltage Tests Under Varied Conditions Indicated Salt Spray Effects



System Instability

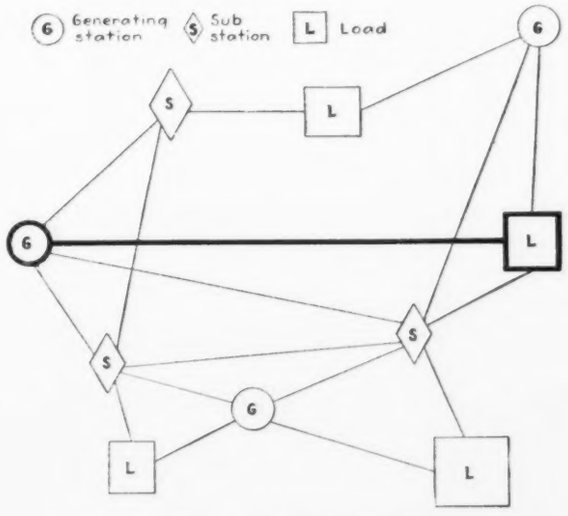
How Four Authorities View Solution

CAUSES of and remedies for instability in its various manifestations were discussed in illuminating detail at the recent meeting of the Great Lakes Engineering Section, N.E.L.A. A rather complete résumé of the symposium is presented here.

AN ELECTRICAL system in its simplest form consists of a source of energy and load with a conductor line connecting the two. In any one of these three elements the conditions that cause instability may exist. As other units are added to this system in the form of additional load, transmission lines, tie lines, substations and generating sources, the stability problem becomes complicated and more difficult to solve. But the solution of every problem is contained in the problem itself, and therefore any electrical system can be made stable under any condition of operation if the solution is sought for and applied when it is found. But here the matter of economics comes into the picture and determines the application of the solution.

During short circuits or other disturbances causing excessive current flow generators are partially unloaded owing to the lowered system voltage. Under these conditions, Robert Treat, General Electric Company, points out, they tend to increase their speed and frequently pull out of synchronism.

One way toward solution is to attempt to keep the magnitude of disturbance current low. This may be done by attention to the system layout, such as the avoidance of too much concentration of power on any one bus. It may be done by the liberal use of bus and feeder reactors. The small use of high-tension buses and the operation of transformer units integral with transmission lines is found to be helpful. For protection of short circuits from single conductors to ground neutral impedances are of benefit.



Elements that Contribute in Varying Degree to Instability

The heavy lines indicate a simple system of generating plant, transmission line and load and the lighter ones illustrate the greater complexity of the stability problem after addition of substations and tie lines.

In addition to reducing the magnitude of disturbance currents, efforts can be made to reduce the duration of these currents. Because of inertia, synchronous machinery cannot go out of step instantly, and if the duration of the fault current can be made so short as to come within the period of that inertia the effect of disturbances will be greatly minimized. For this reason it is most desirable to use high-speed circuit breakers and relays.

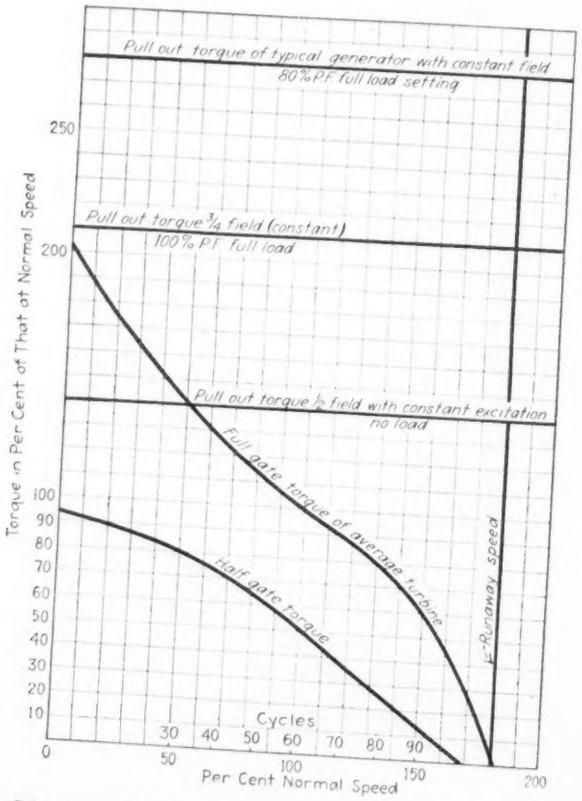
Another method would be to reduce the power input to the prime mover commensurate with the reduction in the output of the generator. Recent tests indicate the possibility of reducing the steam input in sufficient time to prevent loss of synchronism. One of the earliest proposals for preventing loss of synchronism from short circuits was to restore system voltage to normal by promptly increasing the excitation of the generator. This called for a quick response exciter. There is unquestionably a benefit from thus increasing the excitation, but probably not so much as was first expected. There is some evidence that in many cases when machines are knocked out of step the actual loss of synchronism occurs not during the short circuit but somewhat afterward. When this is the case the stabilizing type of voltage regulator is of value.

The tendency of systems connected by tie lines to pull out of step is greatly minimized by holding the frequency of each system independently of the other as close as possible to normal. Present developments in automatic frequency control appear to justify optimism in regard to possibilities along this line. The utility of a synchronous condenser as an aid to stability is a subject on which opinion is divided. Until a conclusion is reached it would not appear advisable to install synchronous condensers primarily as an aid to stability.

While a steam turbine pulls out of synchronism by overspeeding, the exact contrary is the case with a hydraulic turbine, according to Forrest Nagler, Allis-Chalmers Manufacturing Company. He defines generator instability as that quality of a unit which permits it to get out of step or out of synchronism with

other units or with the line or system which is served by the generating unit.

A generator is like a gear connecting the hydro-turbine to the line or load—a gear with rubber teeth, the stiffness of which depends upon the degree of excitation. Ordinarily these teeth are strong enough to withstand from three to four times full torque of the turbine without slipping a cog. With low excitation, incurred either deliberately for the purpose of correcting power factor



Hydro-Turbine Pull-Out Torque Is a Function of Excitation and Bears Inverse Relation to Speed

or accidentally as the result of surges on the line, the margin of stability is considerably less. When the margin gets down below unity the rubber teeth slip, but slippage does not stop with the first tooth. It is extremely likely that the slippage will continue until the driving force is reduced.

This metaphorical slippage occurs only when the driving torque exceeds the hold-in or synchronous torque. The driving torque of a hydro-turbine cannot be increased above its normal full-load torque unless the speed is reduced below normal. It is thus evident that a unit can go out of step only by reason of reduction of its synchronizing or hold-in torque on the generator end. A governor can work only within the torque limits of a turbine; consequently, it can have no direct effect on the instability of a unit. This has been proved in repeated instances where units show similar instability characteristics, regardless of whether they are controlled by a governor or simply by a hand gear. As a matter of fact, a unit controlled by a governor is somewhat more likely to show instability than one which is not. This is because instability occurs only at speeds below normal. The reaction of a governor to a speed that is below normal is to open the gates in the effort to develop more power and hold up the speed. This opening of the gates naturally develops greater torque on the turbine shaft and aggravates the condition which results in the unit going out of step.

Devices can be added to a governor which will reverse its natural inclination to open the gates. Such devices, substantially in the form of a solenoid actuated by reason of excess current resulting from an electrical surge, operate to lift the pilot valve stem independently of the flyballs, and thereby decrease the turbine gate opening. In the average plant such devices would hardly serve to improve conditions materially, because the inactive time of the governor of perhaps a quarter of a second is undoubtedly very long compared to the duration of the impulse or surge that permits the first slippage of a pole. Observation in several instances has seemed to show that the electrical disturbance that causes the difficulty is practically instantaneous, whereas the full stroke of the governor is measured in seconds, varying from one to four in the average plant. In plants involving penstocks of appreciable length a nullifying or reversal of the governor action might introduce a positive detriment to the corrective feature desired, because in such plants the first closing motion of the gates results in a measurable and observable increase in power. Such increase might conceivably create a condition of instability rather than correct it.

Diligent inquiry has failed to identify any cases of instability at speeds above normal, such as would result from sudden dropping of the load. On the contrary, the most outstanding cases of instability have occurred during conditions where the speed is below normal, the gates wide open and sudden or periodic disturbances occur on the transmission line. Under these conditions, once the unit is out of step, it is practically necessary to close the gates and resynchronize. If the line is still alive the frequency is often still abnormally low, so that governor operation at normal speed is not sufficient to permit getting the unit back on the line. It must be brought in at a point considerably below speed.

These facts seem to confirm present efforts to improve stability, namely, through the excitation supply to the generator. This is entirely logical because the biggest variation in the transmission system between turbine and load is the stiffness of the "rubber teeth," caused purely by excitation.

Stability of Transmission Lines

"Stability may be defined as the capacity of a power system to remain in equilibrium under steady load conditions, plus the capacity to regain a state of equilibrium after a disturbance has taken place," according to C. L. Fortescue, Westinghouse Electric & Manufacturing Company. He has demonstrated by a mechanical model that the general aspect of the stability problem is quite simple. The great trouble with analytical methods of computation is that the general aspect remains in the background, obscured by a cloud of esoteric symbols. By means of the model, inherent stability under normal steady state operating conditions, the nature of the electromechanical oscillations associated with switching phenomena, the effect of the severity and duration of system faults and means for improving system stability, such as the intermediate condenser station, high-speed breakers and quick response excitation, can be illustrated.

Lightning is responsible for practically all the faults on transmission lines which come under the classifi-

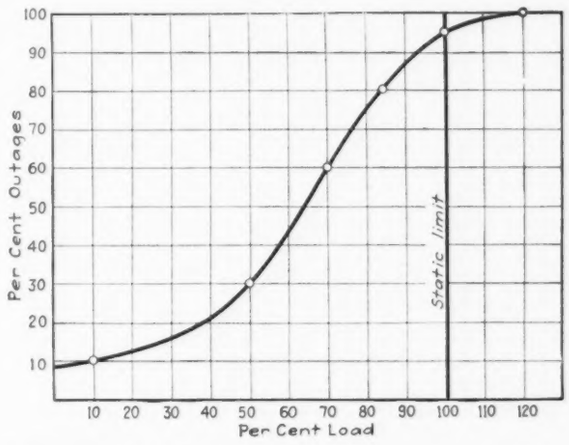
cation of unavoidable faults. Lightning is probably also indirectly responsible for the majority of faults caused by failure of apparatus, as the effect of stresses due to lightning on fiber insulation may be cumulative and finally result in actual breakdown of apparatus.

As the load on a system approaches the limit of equilibrium, the percentage of outages that will result from a fault increases. Conversely, if faults could be eliminated from consideration in the operation of power systems it would be possible to operate much closer to the static or equilibrium limit than is now practicable. This means that the investment in power transmission lines per unit of power generated and transmitted could be very substantially reduced. Therefore the investigation of the effect of lightning on transmission lines and the development of means to protect the line against outages due to lightning are fully justified from an economic standpoint.

General System Problem of Stability

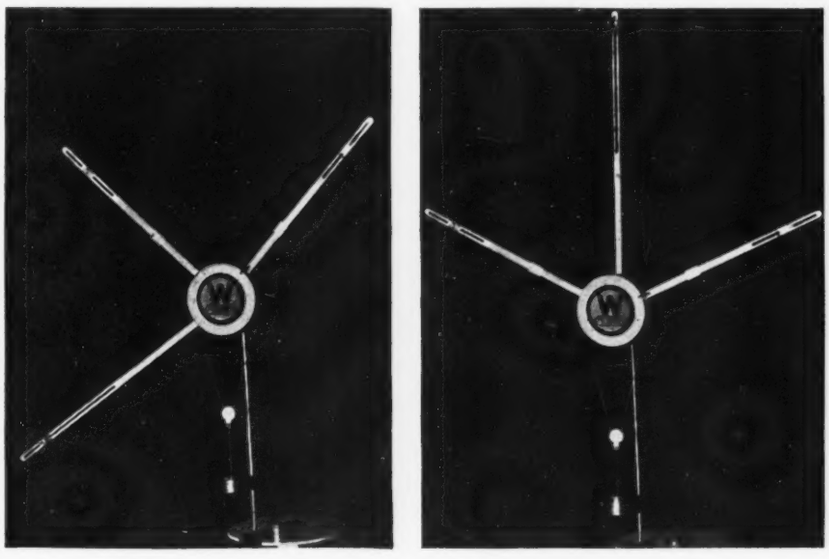
The problem of stability was brought out of the field of purely engineering into the domain of actual operating practice by J. H. Foote, Stevens & Wood, Inc., who said that instability is largely due to interconnections and that smaller utilities will usually experience more difficulty than large ones with more closely knit systems. This situation is usually caused by the small capacity or high reactance of the interconnection, which may be only large enough to supplement the inadequate plant capacity on the small system. As a result the tie fails to hold the generators of the smaller system in synchronism with those of the larger during a disturbance. Remedies may be to increase the interconnection capacity, to minimize the number or duration of the disturbances, or to cut loose from the larger system when trouble on that system occurs. Such solutions must be tempered by economic considerations, since an increase in the interconnection capacity sufficient to effect stability during a severe disturbance may require the rebuilding of a considerable portion of the switching equipment of the plant.

The larger system interconnections often cause less trouble from instability than do the smaller, in spite of the very large capacities interconnected. This may be due to the fact that the capacity of the tie approximates the capacity of one unit of one of the systems and that the tie may be normally operated under a small load so that a relatively large change in power flow is necessary for it to cause loss of synchronism. Closer speed regulation helps to maintain the power flow at predetermined values, thus maintaining the proper reserve for emergency use. Carefully worked out relaying and isolation of faults in minimum time and without shunting too great a load to the tie is of perhaps the greatest help in maintaining stability of such large capacity ties.



Characteristic Shape of Transmission-Line Equilibrium Limit Curve

Outages from instability fix the extent of line capacity utilization and as research on outage causes is followed by remedial measures greater use of transmission line investment may be made.



A Mechanical Analogy Helps to Explain Transmission Line Instability

The arms are connected by a spring representing the line. The angle between them is the vector separation between source and load voltages. As weight, simulating load increase, is added to the pulley suspension at the bottom the angle becomes larger until finally is reached a state of instability at which any disturbance causes the vector to exceed the critical angle and the system to fail. By the use of additional springs between the arms representing lines in parallel, such operation can be illustrated, as can also the effect of condenser capacity at one or more points on the line or lines by the introduction of supporting points along the length of the springs. At the left is indicated a simple line on which an unstable condition is reached when sending and receiving vectors are separated 90 deg. As more load is added the arms pull apart and fall, i.e., the line goes out. The other condition shows the effect of an intermediate condenser, permitting heavier load and wider separation of vectors before pull-out.

An Average System Condition

The problem presented by a system having distributed load and generation areas may be complex to solve. For example, it may contain (1) steam plants located near favorable condensing water sites which may or may not be located in load areas; (2) hydro plants located only with regard to power-producing abilities of various rivers; (3) load areas scattered throughout the territory; (4) transmission lines connecting all these units; (5) interconnections with other utilities at various points, possibly remote from one another.

Such a system is probably the result of combining many smaller systems at different times and may lack symmetry of design or unity of plan. The interconnections may have been made in an expedient manner, but not with stability of operation in mind.

Variations of demand throughout the hours and days of the week may require constant readjustment of power generation and flow. Water in hydro plant ponds must not be wasted and often can be stored for only short periods. During periods of high water flow, hydro power may spread to all parts of the system and the transmission lines may be adequate for this service. During dry flow periods, the steam plants must transmit power, perhaps to the majority of the load. It may not have been economically feasible to provide the equivalent of two complete transmission systems, one to distribute hydro and the other steam power to the loads, even though geography would seem to so require.

It is therefore not unusual to find sections of such a system which are inadequate to transmit the power necessary for stability in the event that some power channel is interrupted while under heavy load.

Generation and Transmission Need Co-ordination

Many methods may be called upon to solve such stability difficulties. First, a comprehensive system study should be carried out and new construction effected to build up a more compactly arranged transmission system which will bring generators and loads more directly together. By making groups of loads and "all-year" generator capacities more or less self-sustaining, a measure of inherent stability is attained in case of transmission line disturbance. Ties between groups must be strengthened and augmented to care for failure. Excitation may be improved if it is faulty, but excitation improvement will not substitute for inadequate tie capacity.

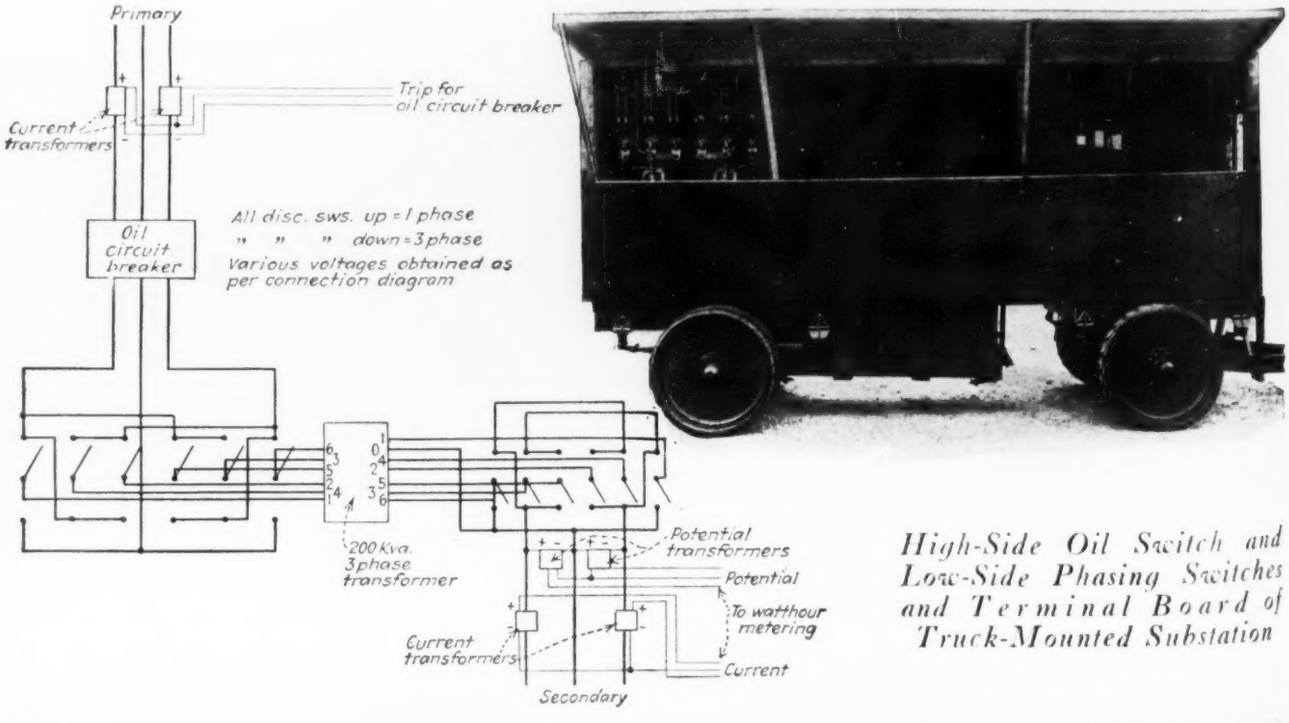
Of course, reducing the number of insulation failures will improve operation and correspondingly reduce the number of troubles resulting in instability, but such disturbances may originate on the lines of an interconnecting company over which no supervision is possible. Neutral grounding equipment of a sort designed to mitigate disturbances resulting from insulation failures may help. Speedy isolation of faulty apparatus or lines may assist, although if the loss of the line leaves an inadequate connection, instability may still ensue.

These and other remedies must usually be applied gradually over a term of years, because of economic or financial considerations.

Summing up the matter, it appears that in arriving at a solution for instability it is first necessary carefully and thoroughly to survey the system, its equipment failures, its operating necessities and its behavior under stress. The results of this analysis should indicate the line of treatment which will be most effective, and probably most if not all possible remedies will be called upon for aid in the solution. As such studies are made and analyzed, new solutions will appear, and as the remedies are tried out experience will indicate the most effective means of combating this most elusive of present problems in electrical system operation.

Portable Emergency Substation

THE problem of supplying temporary loads, meeting changes in the customer's installation or providing emergency service in cases of transformer failure has been met by the Connecticut Light & Power Company by the building of a portable station of wide applicability. The trailer truck pictured houses a Pittsburgh three-phase transformer which can quickly be connected for either three-phase or single-phase operation at full rated capacity of 200 kva. with primary voltages of 13,800/4,600/2,300 and supplied voltages of 460/230/115. The line diagram shows the connections which make this flexibility possible. It is known that the money spent in assembling this outfit has been more than saved in avoiding the erection of temporary structures and the installation of temporary equipment.

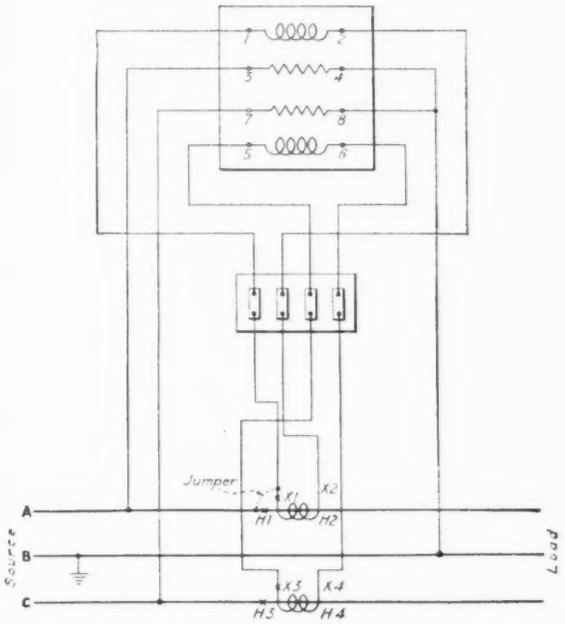


High-Side Oil Switch and Low-Side Phasing Switches and Terminal Board of Truck-Mounted Substation

Verifying Connections in Low-Tension Metering

By A. F. Newman

Foreman Meter and Test Department, New York & Queens Electric Light & Power Company



Connection Check for Low-Voltage Meter Installation

(For three-wire circuit; one, two or three phase)

TO FILL a need for a quick and simple method of determining the correctness of the connections on low-tension metering installations employing current transformers what is called the "lamp method" has been devised. It requires only a set of test leads with "Universal" test clips and a 100-watt lamp.

The ground connection of the current transformer secondaries is removed and then a test made from the live leg of the circuit to each current transformer to make sure there are no other grounds. A jumper is then placed from the live wire (H_1) to the line side (X_1) of the current transformer secondary winding in the same live wire. Of course these steps prevent the use of the method on any but low-voltage circuits. The following connections of the test lamp determine by the resulting indications the correctness of the connections to the upper element. The jumper is then removed and replaced in the corresponding position on the other live wire carrying a current transformer. Then the corresponding points of attachment of the test lamp will verify the connections of the lower element of the meter. On completion of the test the jumper is removed and the ground restored to the current transformer secondary circuit.

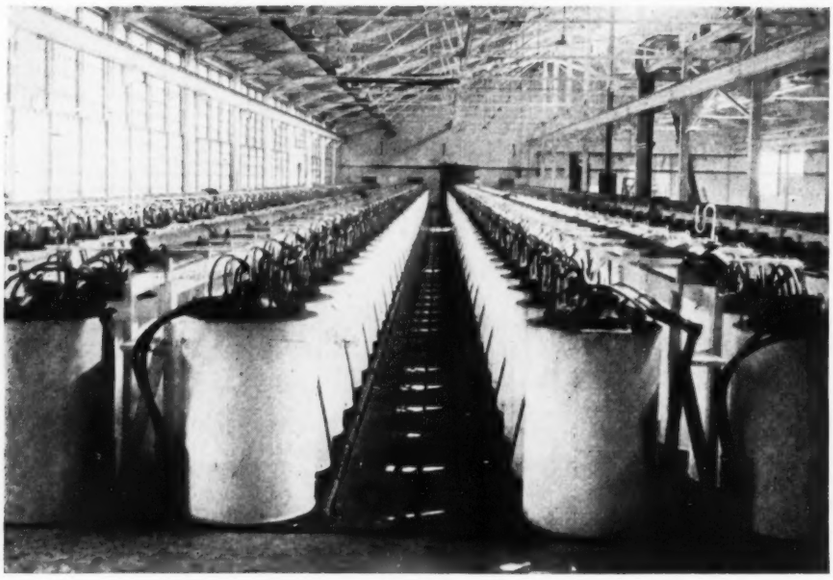
Test Lamp Check of Low-Voltage Meter Connections

Test	Lamp Indication	Meaning of Indication
Ground to 1	Bright	A-phase current transformer is connected to upper element of meter.
Ground to 5	Dark	
1—3	Dark	The proper potential is applied with A-phase transformer. If the lamp shows bright it indicates crossed potentials at the meter (incorrect connection.)
2 to ground	Bright and forward rotation of meter	The current transformer feeds to the proper side of the meter. If meter carries load an increase in speed will be observed when making this test. Connections are correct. If no rotation results the connections are incorrect.
House side of sec. (X2) to ground.	Bright	Closed circuit from feed to return of transformer. If lamp shows dark there is a break in the current circuit.

Clearing Right-of-Way with Power Saw

THE use of power-driven circular saws for cutting up timber into transportable lengths in right-of-way clearing operations is comparatively common. But a power saw that is used for actual felling of the trees is not so frequently met with. In fact, this problem of applying power to the cutting down of trees is one that has engaged the attention of timber operators as well as line construction crews for a long time. In the Wolf chain tooth saw the Hoosier Engineering Company believes that it has found an economical and effective piece of equipment to be used in locations where it is possible to bring it in and where the tree diameters are not more than 2 ft. Power for the saw used by the Hoosier company is furnished from a power plant made by the Universal Motor Company. The plant has a capacity of 7½ kva. at 240 volts, three phase, 60 cycles. The saw is used for cutting up the trees after they have been felled also and it has been estimated that a saving of 25 per cent is made in that part of the clearing operation involving felling trees.

Motor-Driven Saw May Be Used Close to Ground Level



A Bay Containing 560 Vorce Cells

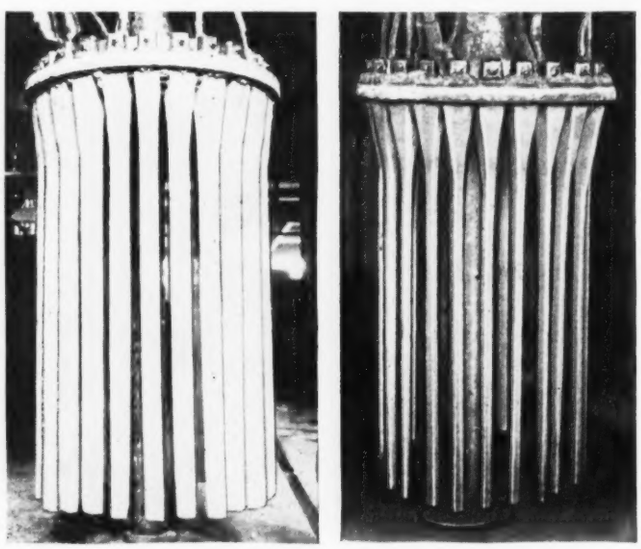
60 Tons of Chlorine a Day

Made Electrically

THE Vorce cell has been adopted by the Westvaco Chlorine Products Company of South Charleston, W. Va. This company has recently added 2,240 cells to its plant with a capacity of more than 60 tons of chlorine a day and the features of the new cell are largely that it saves floor space, is highly efficient, is easy to maintain and that it can be built in the plant.

Over-all dimensions of the cell are 26 in. in diameter and 42 in. in height. The cathode pot is $21\frac{3}{4}$ in. in diameter and the steel container tank is 38 in. high. In an eight-hour day six men are able to handle replacements and maintenance for the entire installation. Two men can remove and replace 35 cells per day.

Considerable experimental work was done in connection with the treatment of graphite with the primary thought in mind of increasing the age or life. Each anode assembled weighs 203 lb. The size of graphite, 2 in. x 2 in. x 36 in., has presented a difficulty not encountered in any other sizes. The usual life of this size graphite is approximately twelve months when cells are operated at 1,000 amp. and 250 volts. The accompanying illustrations show that the size of the graphites at thirteen months have deteriorated very little and also that while twice the ordinary age they are as large as untreated graphite at twelve months. Records of test indicate that the average voltage over the life of the graphite is no greater for treated than untreated graphite.



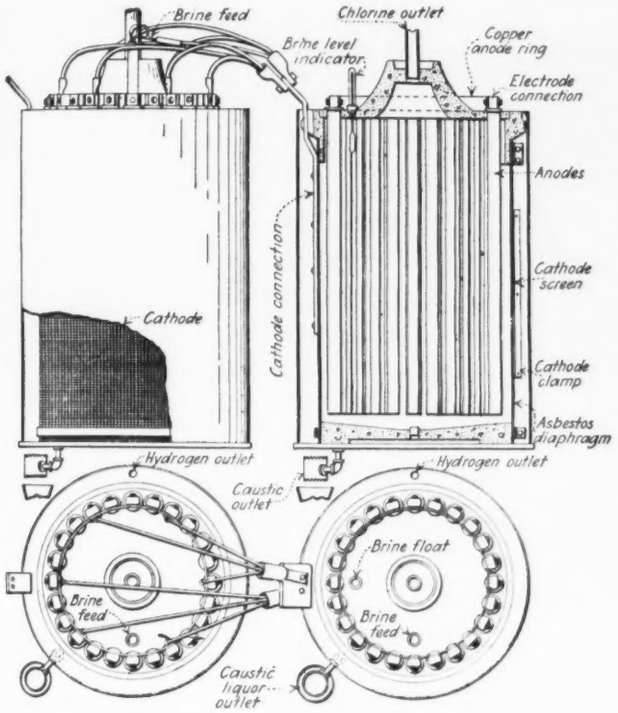
Treated Carbon Anode Showing Changes Following Intervals of Thirteen Months and Two Years of Operation

The assembling of the anode is a simple, quick operation. It is completely assembled on a stand and is then picked up by the crane and set in the cell.

The method of handling the cells by use of cranes facilitates the repair work and speeds it up, as the cells are taken from their places and new ones set in promptly, thus losing very little of the total production. The only time loss in production on account of repairs is while a cell is being disconnected, moved out

and the new one is being set in place. This is accomplished by having enough spare equipment and in reality gives a continuous operation. In order to operate as above, it requires about 2 per cent, or 45, extra cells. These are continually going through the stages of repair.

These individual cells, operating at 1,000 amp. and 3.5 volts, will produce 65 lb. of chlorine per cell at 93.5 per cent current efficiency in 24 hours. The circuit voltage



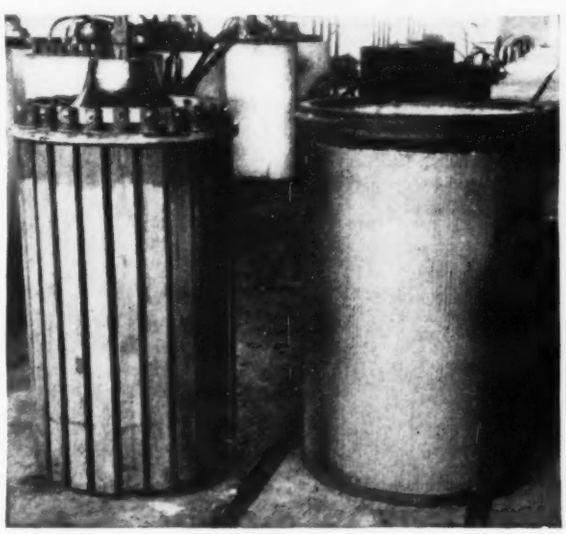
Elevation, Cross-Section and Plan of Vorce Cell

is approximately 250 volts. The total floor space occupied by the 2,240 cells is 160 ft. x 205 ft., or 32,500 sq.ft. This is equivalent to 14.7 sq.ft. per cell. The fact that the cell is arranged on supports gives it the advantage of gravity flow throughout and no overhead lines interfere with the free use of cranes when repairing cells.

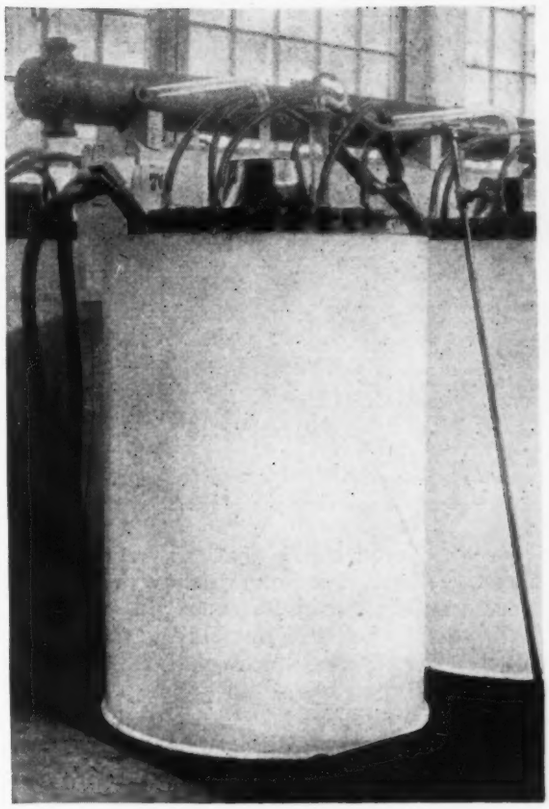
At the stated efficiency the cells will produce the equivalent of 145,600 lb. of chlorine, or 728,000 cu.ft. per day. This is equivalent to 22.4 cu.ft. of chlorine per square foot of floor space required, or 4.5 lb. per square foot of floor space.

Another point of interest is the fact that the brine entering the cell is preheated to 170 deg. F.

In building the Vorce cell three concrete rings or sections of special composition are cast in iron molds under pressure. Ground asbestos is used with the portland cement in the mix, in order to make the rings light in



Assembled Anode and Cathode of Vorce Cell



Cable Connection, Brine Feed and Gas Outlet of Vorce Cell

weight, and their circular design gives them ample strength for their purpose. The upper ring, or dome as it is called, holds the 24 Acheson graphite anodes, which are about 2 in. square in cross-section. The ends of these carbons have been machined and threaded so that they extend through the concrete ring and are securely fastened to it by hard-rubber nuts. The carbons are then bolted directly to the copper anode ring. Thus there is no joint in the carbon inside the cell.

The chlorine is withdrawn from the top of the cells through a glass connection fitting securely into the 4-in. stoneware collection mains that serve each series of 70 cells. Downpipes from the 4-in. mains are connected to 6-in. and 8-in. stoneware pipes that carry the chlorine to the cooling coils, which are also of stoneware. After passing through these coils the chlorine is dried by passing it against 66-deg. sulphuric acid in two stoneware towers 32½ ft. in height and 36 in. inside diameter.

The hydrogen gas, collected from the outlets of the cells, is piped to an adjoining plant, where it is consumed in chemical manufacture.

The power plant of Westvaco Chlorine Products, Inc.,

Average Results of Monthly Test Runs Made on Vorce Cells at Westvaco Chlorine Products, Inc.

September 1, 1927—January 1, 1928

Specific gravity of liquor	1.211
Percentage of NaOH	8.607
Percentage of NaCl	15.79
Percentage of Na_2CO_3	0.115
Percentage of NaClO	Trace
Percentage of $NaClO_3$	0.068
Percentage of Cl in gas	98.3
Percentage of CO_2	0.7
Gallons of liquor per cell per hour	3.417
Pounds of caustic per cell per day	71.42
Pounds of chlorine per cell per day	63.15
Pounds of caustic per kw.-hr	0.859
Pounds of chlorine per kw.-hr	0.793
Pounds of caustic per kw. day	21.42
Pounds of chlorine per kw. day	19.08
Average amperes per cell	948.1
Average volts per cell	3.5
Temperature of brine, deg. F.	147
Current efficiency (per cent)	94.84
Power efficiency (per cent)	62.11

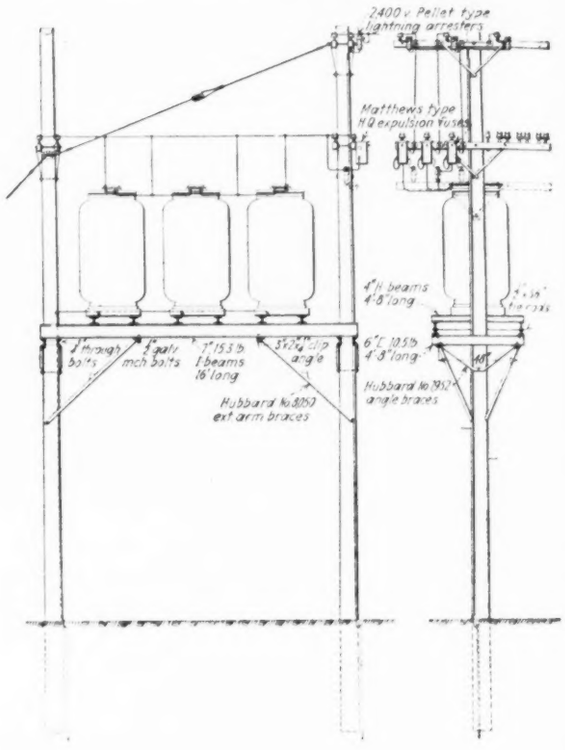
is a rotary converter station that consists of four Allis-Chalmers 3,250-kva. synchronous converters running at 187 volts on the alternating-current side and 250 volts on the direct-current side. In addition, there is a turbo-generator which operates non-condensing, its exhaust furnishing the process steam requirements of the Westvaco plant.

The cells are operated at 1,000 amp. and 250 volts for each series of 70 cells. The distribution feeders were especially designed by the Ferguson company in collaboration with plant engineers, in order to give a uniform voltage drop at the cell terminals.

Estimating Line Costs

THE practice of a Middle Western utility serving a large area in furnishing local employees with means for estimating the costs of line extensions was shown in items appearing in the ELECTRICAL WORLD of September 14, 1929, and November 9, 1929. The unit costs for two other conditions are reproduced here. Others will be published in later issues.

Removable Steel Platform Aids Transformer Changes


2400-v. Pellet type lightning arresters
Matthews type HQ expulsion fuses
4"H beams 4'8" long
6"C 10.5 lb. 4'8" long
7"15.3 lb. I beams 16' long
5"x3½"x½" angle
Hubbard No. 8050 ext. arm braces
Hubbard No. 7952 angle braces

AVOIDANCE of outrigging for raising and lowering transformers has been accomplished in the design by the Rochester Gas & Electric Company of a steel platform in which the floor is removed and the transformer lifted between the side rails directly to its resting place. The one shown in the accompanying illustration takes care of installations ranging from 75 to 200 kva. rating.

Another has been developed for 15 to 50 kva. in which crossarm construction is employed, the standard hangers for pole mounting being used in this case.

Costs of 1 Mile of 33-Kv., Single-Circuit Line

With three No. 1 conductors in flat configuration on 35-ft. and 30-ft. poles spaced 225 ft.

Material	Size	Quantity	Unit Price	Item Cost
Poles	25 ft.	1	$6.50 ea.	$6.50
Poles	40 ft.	2	16.95 ea.	33.90
Poles	45 ft.	2	18.85 ea.	37.70
Crossarms	10 ft.	30	115.00 C	34.50
Crossarm braces	No. 7953	30	80.95 C	24.29
Keystone stands and pins	No. 263	90	59.50 C	53.55
Carriage bolts	½x6 in.	60	3.95 C	2.37
Machine bolts	⅝x12 in.	6	8.92 C	0.54
Machine bolts	⅝x14 in.	18	9.50 C	1.71
Machine bolts	⅝x16 in.	2	10.28 C	0.21
Machine bolts	⅝x18 in.	2	12.12 C	0.14
D. A. bolts	⅝x16 in.	4	13.84 C	0.55
D. A. bolts	⅝x18 in.	4	14.56 C	0.58
Lag screws	½x3½ in.	40	24.99 M	1.00
Guy wire	⅜ in.	500 ft.	17.15 M	8.58
Guy clamps		12	19.79 C	2.38
Guy hooks		10	7.79 C	0.78
Strain plates		10	6.66 C	0.67
Anchor rods	¾x6 ft.	5	54.95 C	2.75
Ever-stick anchors	8 in.	5	2.00 ea.	10.00
Guy thimbles	½ in.	5	4.50 C	0.23
Eyebolts	3x12 in.	6	20.34 C	1.22
Insulators (Thomas pin type)	No. 2124	91	229.50 C	208.85
Insulators (J. D. complete)	A-257	6 str.	5.40 ea.	32.40
Strain insulators	No. 504	2	13.29 C	0.27
Wire MHD bare copper	No. 1	4095 lb.	20.00 C	819.00
Wire soft drawn (tie wire)	No. 6	45 lb.	20.00 C	9.00
Copper sleeves	No. 1	3	20.00 C	0.60
Ground rods	½x6 ft.	5	66.20 C	3.31
Sq. washers	2¼ in.	150	15.64 M	2.35
Sq. washers	4x4x¼ in.	5	3.58 C	0.18
Traffic guards		1	1.55 ea.	1.55
Total—Material common to 35-ft. and 30-ft. pole construction				$1,301.76
Add to $1,301.76 for 35-ft. pole construction.				
Poles	35 ft.	23	$12.90 ea.	296.70
Total—Material for 35-ft. pole construction				$1,598.46
Stores department—10 per cent				159.85
Labor				372.00
Transportation and supplies				95.00
Total—material and labor				$2,225.31
General office supervision				222.53
Total for 35-ft. pole construction				$2,447.84
Add to $1,301.76 for 30-ft. pole construction.				
Poles	30 ft.	21	9.85 ea.	206.85
Poles	35 ft.	2	12.90 ea.	25.80
Total—material for 30-ft. pole construction				$1,534.41
Stores department—10 per cent				153.44
Labor				372.00
Transportation and supplies				95.00
General office supervision				$2,154.85 215.49
Total for 30-ft. pole construction				$2,370.34

Now Is the Time to

Push

Customer Ownership*

By
CREIGHTON J. HILL
Babson Institute,
Wellesley Hills, Mass.

NOTHING that has happened in the stock market during the past few weeks has in the least affected the essential value and importance of customer ownership. Emphasis must be laid on the imperative necessity of not allowing the reaction to upset the long and patient campaign of education in behalf of customer ownership carried on by the utilities during recent years.

As the consequences of the stock market break become more clear with the passage of time we are realizing that from now on we will be in a period when speculation based merely upon prospects of advance is going to be entirely eliminated. In its place earnings and yields will be the guiding factors to which investors will look in selecting securities.

Our organization would be false to its responsibilities if we were to gloss over the business outlook for next year with any idle words of optimism at the present time. The essential foundation for good business is a proper appreciation of the facts as they really exist. For a long time we rode higher and higher on a pyramiding stock market without being willing to face the truth. We would be equally blind if we failed to face the truth in regard to the business outlook for 1930. Now I realize that this is not a talk on the outlook and I am not going to get into any extended discussion on that subject. I will simply say that while it is difficult at this point to forecast how much deeper the blow will strike, yet this stock market crash is absolutely certain to affect business to some extent.

HAMMERING OF PRICES DID NOT DESTROY VALUES

Now, however, let me offset that statement slightly by saying that the public utilities should continue to expand. The savage hammering which public utility stocks received in the recent market crash was a matter involving quotations and not essential values. The long-term outlook for public utilities is brighter today than it ever has been in the history of the industry. A steady increase in power consumption is inevitable, and while, of course, there may be a slight reflection of any temporary recession in general business activity, yet we feel that the light and power industry has very little to worry about in terms of fundamentals as regards the outlook for next year.

The other morning I was reading the prospectus of a power and light company offering a new stock issue. My attention was struck by one paragraph in that part of the prospectus which described the history and business of the corporation in question. It reads as follows:

> The success of the company is attributed in a large measure . . . to the unusual service which it gives its customers. The company's system of training its employees, which today number 400, is unique, and is responsible largely for the good will which has been built up.

Here was a statement tossed into the midst of financial statistics which had more significance to me than anything else in that prospectus. It was evidenced not only that wide-awake, forward-looking corporations today consider employee good will and public relationships as among their most valuable assets, but also that prospective investors look for this sort of information concerning a company before they put money into it.

I can remember the time not so many years ago when public relations constituted a vague and nebulous subject with which the average corporation—even the public utilities—did not concern themselves. It was generally considered a sufficient rendering of the account of a public utility's stewardship to the public if it furnished reasonable service.

Today, however, we are in a new era in regard to the relationship between the public utilities and the consuming public. We realize now that good will between the public and the company is not simply a pleasant, though quite minor, factor. We realize, to the contrary, that no public utility can long prosper unless it has the warm friendship of the public which it serves and the confidence of the individual customers who spend their money for gas or electric or railroad expenses every day of their lives.

One of the outstanding features in the amazing growth of power and light industry has been its everlasting willingness to keep abreast of the rapidly changing developments in the science of electricity. We are inclined to point to the reduction in the cost of electricity as the primary evidence of the development of the power and light industry. However important this is, we should not lose sight of the fact that price is of secondary importance in power and light as compared with service.

**From an address to the Public Relations Section, New England Division, N.E.L.A.*

The first requirement of electric service today is, of course, that it be abundant, reliable and constant. The flexibility of electricity is one of the main reasons why its use has advanced so tremendously during the past two decades. As a result of this advance, our entire American standard of living has been raised and the American people have come to be so dependent upon the use of electricity for light, heat and power that its sudden withdrawal would actually create a tragic emergency in all our big cities.

The disaster and distress which would follow any sudden annihilation of electric power and light stagger the imagination. Under these circumstances, those who are directing this vital industry have a greater sense of public responsibility than any statesman could have in questions of political or economic significance.

The fact is, I believe, that the safety of our country and its future development are in the hands of men such as are guiding the interests of our power and light companies far more than it is dependent upon our lawmakers and our public officials. We are living in an age of the dynamo. It was but a few years ago when the public was suspicious of power and light corporations as years before they were suspicious of the railroads. I do not mean to say, of course, that no criticism is ever justified. To the contrary, I believe that wherever a business is fraught with direct public interest it should never be divorced from public regulation and from a continuous active interest on the part of the public in how that business is run.

It is entirely possible, therefore, that in particular cases criticism against the operation of certain power and light corporations has been justified. But these incidents are not in any way indicative of the sense of trust which the great majority of those men in control of the power and light business have felt from the beginning. Furthermore, during the last decade there has steadily been built up a good will on the part of the public which is perhaps more accurately reflected in one specific way, although clearly indicated by many others.

This single proof of the public's confidence in our great power and light companies may be found by glancing at the list of the stockholders of any one of these companies. It is not generally realized that 14,000,000 people are today devoting their attention to the purchase of stocks of the corporations of America, compared with 2,000,000 in 1914. Of this number, a greater proportion have invested in the public utility industry during recent years than in any other single line of business. This public confidence has not been created over night. It has been built up through years of insistent and intelligently planned public relationships.

Pendulum Swung Too Far

High-power salesmanship has not been an unmixed blessing wherever it has been applied to our problem of distribution. In fact, we are now in a measure reaping the whirlwind of some of this high-power salesmanship as it relates to certain stocks which were sold to the public on the basis of prospective advance in price rather than upon the fundamental values of earnings and profits. As a result, there is no question but what for a time the public will be a little skeptical of not only common but even preferred stocks. Just as the pendulum swung too far in the over-intense interest in common stocks up to the time of the recent break, just so now will the pendulum swing too far in the other direction for a time. Having been burned by inflated stocks, there will be a tendency to flee to the opposite extreme and invest only in bonds. But intelligent salesmanship of the right sort can quickly capitalize the situation to its advantage, and the sale to customers of power and light stocks should not be hurt by what has taken place. In fact, the power and light industry should be perhaps the most favorable industry to sell to the consuming public, because we stand today only on the threshold of tremendous developments in the use of electrical energy.

The tremendous public interest in the recent 50th anniversary of Edison's invention of the electric light shows how the imagination of the public is caught by the word "electricity." Light and power companies are in a unique position also as regards another factor that offers a question mark to the average investor. Unlike most other businesses, light and power companies have a very little labor item and high capital item. Moreover, the utilities' cost for labor may be further cut by technical improvements. In other words, per unit of production, the light and power company needs relatively few workmen, but large capital expenditures. The ratio sinks as output soars and, added to this fact, it must be realized that increasingly human labor is being replaced by mechanical robots.

As civilization moves forward the utility can benefit on both the demand and supply sides of the equation. Almost every new important invention either multiplies the demand for power or cuts the cost of power production and transmission. The cost of producing and transmitting electrical energy will decrease rather than increase. Owing to the fact that the larger the generating plant the lower the unit cost, such companies have little to fear from competition.

We believe that carefully selected securities of well-managed companies supplying light, power, gas and other utilities are in many ways the best investment now available, considering both security and yield.

Adequate provision of capital, encouraged by business-like and common-sense treatment, will enable the utilities to perform in a wonderful way the function for which they were created. They will became utilities in a sense that will give new meaning to the word "utilities." They will become agents of social service to a degree that will give added emphasis to the word "public."

Montana Commission Opposes Federal Regulation

"WE RESPECTFULLY submit that there is absolutely no need for the creation of a commission on communications and power as proposed in the amended Couzens bill, and further submit that the state bodies now established and functioning are amply qualified to assume any additional supervision and control if such is found to be necessary at any time," declared the Public Service Commission of Montana in a resolution adopted November 5, 1929.

"Nothing would more quickly lead to a collapse of state sovereignty than to deny the people the right to control public utilities that serve them locally.

"The regulatory government made for the railroads will not fit other utilities."

Principles to Guide Water-Power Development

Water-Power Development Committee, N.E.L.A.

1. Whenever the market will justify and the cost will not exceed that of steam or other development, water-power resources should be developed to the fullest practicable extent and in the shortest possible time.

2. The greatest benefit from the large water-power developments of the country, such as the St. Lawrence, Tennessee, Columbia, etc., will be the growth and general prosperity of the adjacent territory which will be due to the industrial growth that naturally follows these developments.

3. In general, the greatest utilization can be secured for water-power developments when they are part of large central station systems. This is especially true if there are other uses of the water, such as irrigation, navigation and flood control, all of which result in variable rates of output whose inequalities can usually be tolerated in or absorbed by a large interconnected system of steam and water power plants.

4. Special charges or taxes assessed against water-power development by federal or state governments limit the extent to which water power can be used to foster industrial development; consequently such charges should not be imposed.

5. Regulation by public agency should be provided (as it now is in practically every state) to secure proper service at fair rates to all consumers.

6. The federal water-power act in its present form can be administered so as to promote the development of all water power for which a market exists, and it provides ample safeguards for the public interest. Water powers for which no market exists should be withheld from development until economic conditions warrant bringing them into use.

7. The tendency to exempt from the jurisdiction of the Federal Water Power Commission any projects over which the federal government has jurisdiction is unsound and leads to undesirable delay and inefficiency in the development of feasible water powers.

Short-Circuit Stress Charts

By William W. Edson

Station Engineering Department, Boston Edison Company

STRESSES between conductors under short-circuit conditions may be conveniently determined on an approximate basis by utilizing the accompanying charts based on the assumption that the conductors are round and that the current flow is concentrated at the centers of the conductors. The diagrams are sufficiently accurate except for large currents in multiple busbar arrangements or for small spacings. The force on the individual bus support is found by multiplying the pounds per foot obtained from the chart by the number of feet of conductor supported by the insulator. As the forces involved in alternating-current work are pulsating, a fairly large factor of safety should be used for flexible structures and especially for conductor fittings which are not firmly clamped.

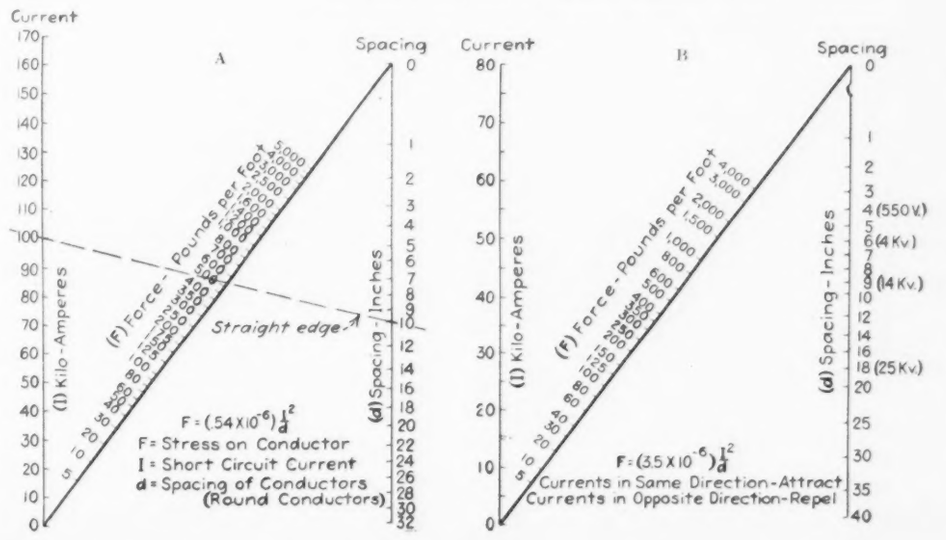
(A) *Direct-Current* (B) *Alternating-Current Short-Circuit Stresses in Lb. per Foot*

To use the chart place a straight edge on the value of amperes involved in the short-circuit and on the conductor spacing used. The intersection of the straight edge with the force line gives the force per foot of conductor. Thus, a 100,000-amp. short with a 10-in. spacing determines the force to be 540 lb. per foot on each conductor.

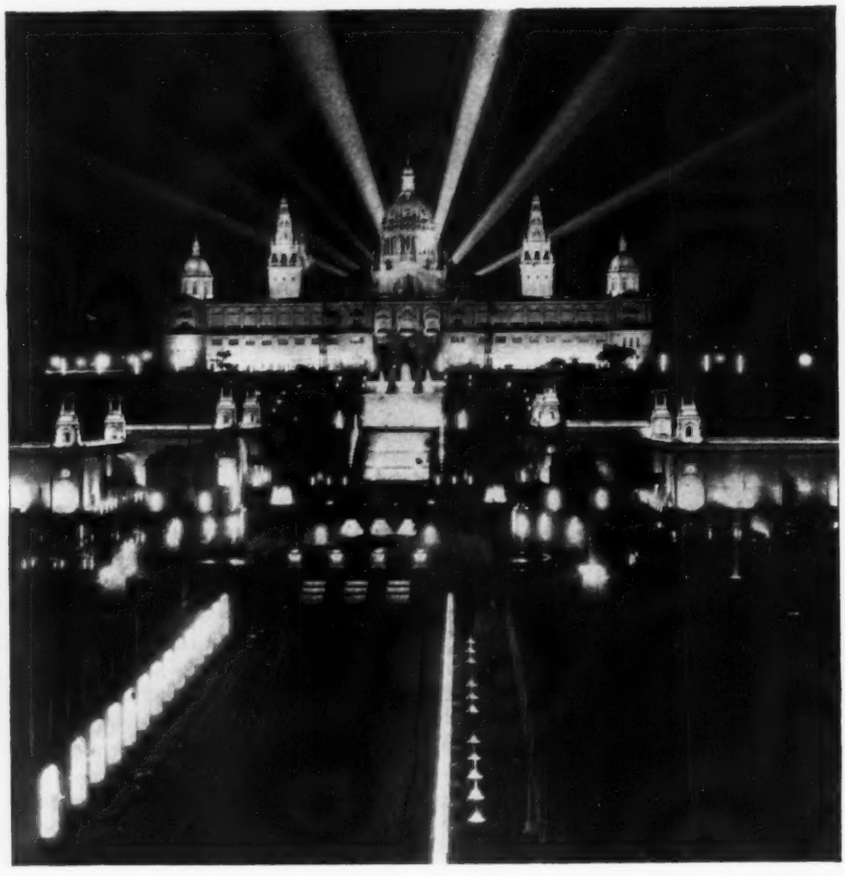
The diagrams are plotted from the formula $F = 2.04\ i_1\ i_2\ (c/b)\ 10^{-8}$ as given in the Standard Handbook for Electrical Engineers. By using English units this reduces to $F = 0.54\ (I^2/d) \times 10^{-6}$. For alternating current, however, the maximum value of the current is 1.41 times the effective or measured value. Also the initial short-circuit transient current may reach 1.8 (theoretically 2) times the calculated value if the fault occurs at time of zero generated voltage. The constant K then becomes $0.54 \times 1.41^2 \times 1.8^2 = 3.5$.

In a three-phase system with triangular spacing each conductor is repelled outward and tends to follow a circle at twice the system frequency. The maximum force, however, is approximately 93.5 per cent of that for a single phase; that is, $K = 3.25$.

For flat spacing the middle conductor tends to vibrate at twice the rated frequency with $K = 3.25$. The outer conductors vibrate outward with $K = 3$.



Light Supreme at Barcelona

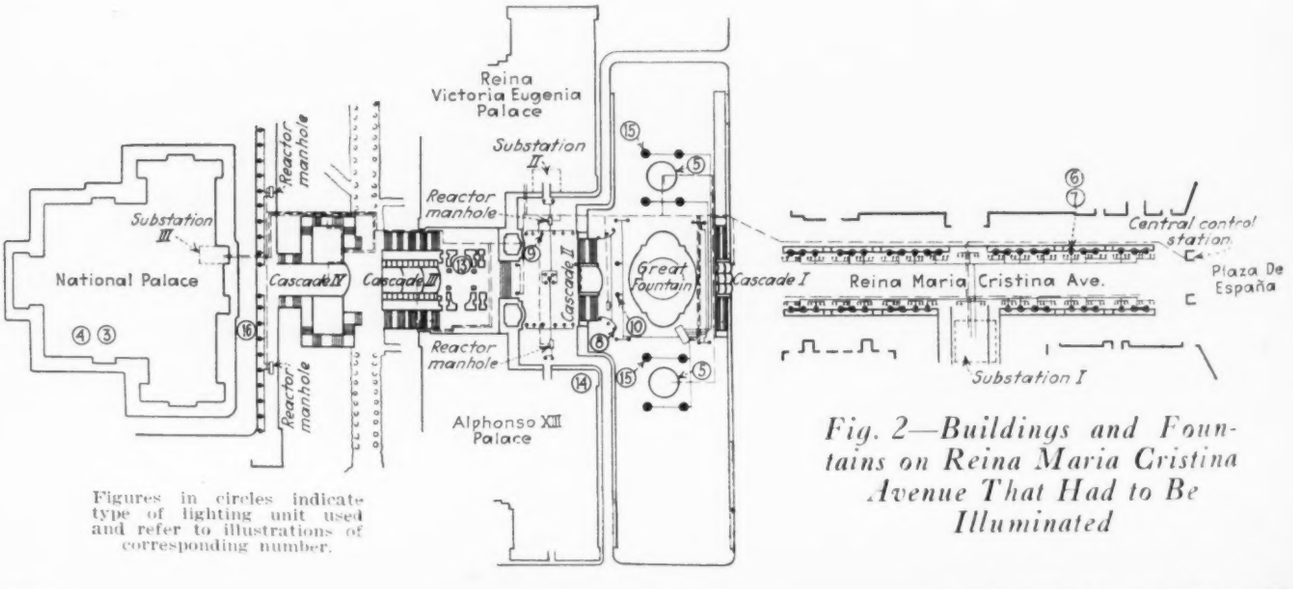


Extraordinary applications of artificial exterior lighting to a vast layout controlled from centralized elevated observation point. Adaptable to buildings, fountains, plazas and parks elsewhere

Fig. 1—Decorative Area at Night Shows Scintillator Beams

UNUSUAL and spectacular effects were produced by color and mobile floodlighting of every type in lighting the International Exposition at Barcelona, Spain. The extraordinary and spectacular effects surpass anything heretofore attempted in color and mobile floodlighting, their splendor enhancing a marvelous natural vista and arresting the interest of thousands of visitors.

The fundamental idea which predominated in this project is the suppression of direct lighting throughout the decorative lighting area. Illumination was obtained either by concealing the lamps or reflectors in cornices or decorative motifs of the buildings, especially in piazzas and façades, or by using elements of artistic design, in many and varied forms, imitating fantastic futuristic flowers or plants, in the avenue and open spaces. To



Figures in circles indicate type of lighting unit used and refer to illustrations of corresponding number.

Fig. 2—Buildings and Fountains on Reina Maria Cristina Avenue That Had to Be Illuminated

By

K. W. JOHANSSON

Westinghouse Electric & Manufacturing Company

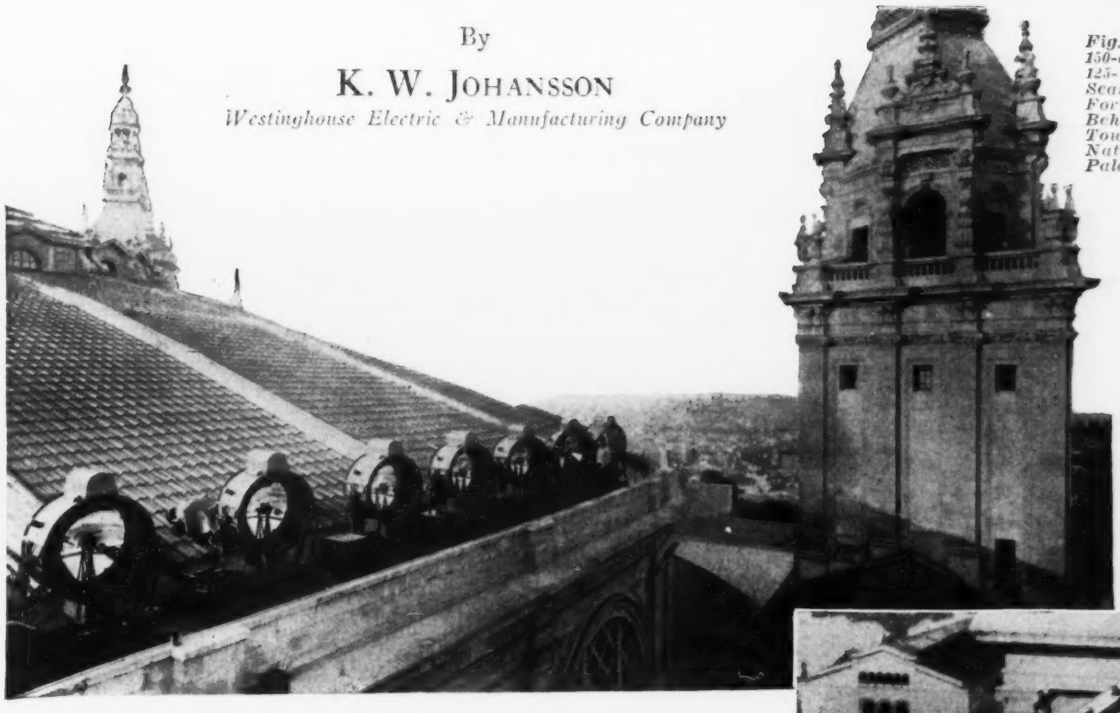


Fig. 3—Nine 150-amp., 125-Volt Arc Searchlamps Form Aurora Behind Towers of National Palace

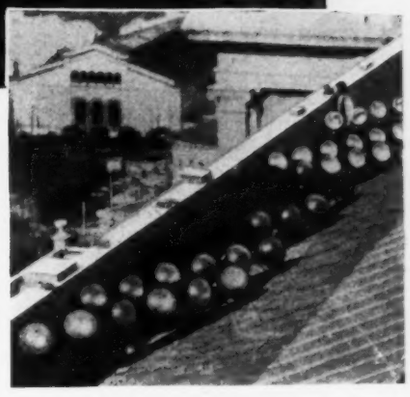


Fig. 4—Some of Floodlighting Units for Towers

the amount of light thus obtained was added that produced by reflectors submerged in the fountains and cascades.

One mobile program is controlled automatically, and another by a lighting expert, who can paint the decorative area in any desired color to suit his fancy. The automatic cycle consists of light waves which commence at the National Palace and descend to the Reina Maria Cristina Avenue, finally reaching the entrance at Plaza de España. For example, the white color commences at the National Palace and goes down slowly through the cascades and steps toward Plaza de España at the rate of $7\frac{1}{2}$ ft. per second. As the white reaches Reina Maria Cristina Avenue the yellow commences at the National Palace and proceeds at the same rate, followed by the red, and finally the blue. One cycle of the automatic program lasts about ten minutes.

At the conclusion of this program the operator can transfer the lights from the automatic control to the manually operated switchboard and illuminate the entire decorative area in white, yellow, red and blue singly or blended. The intensity and location can be varied to produce any effect desired. The cascades and the fountains

Fig. 5—One of Smaller Fountains Illuminated by Under-Water Units. Note Illuminated Foliage

Illuminated Crystal Columns

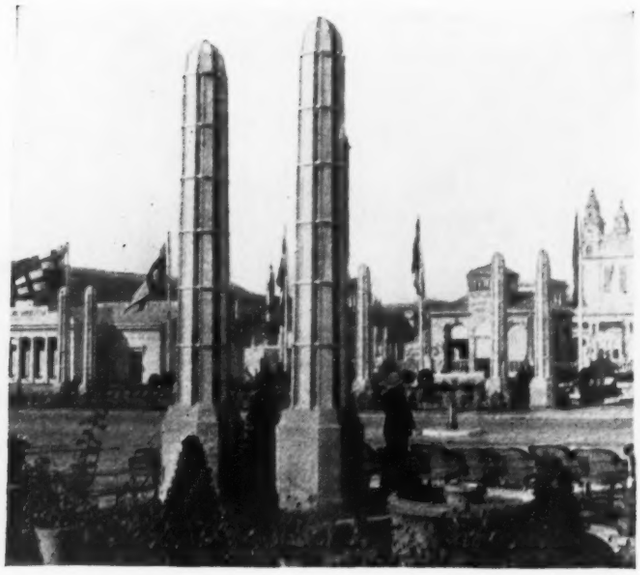


Fig. 6—116 Units Similar to These Line the Reina Maria Cristina Avenue

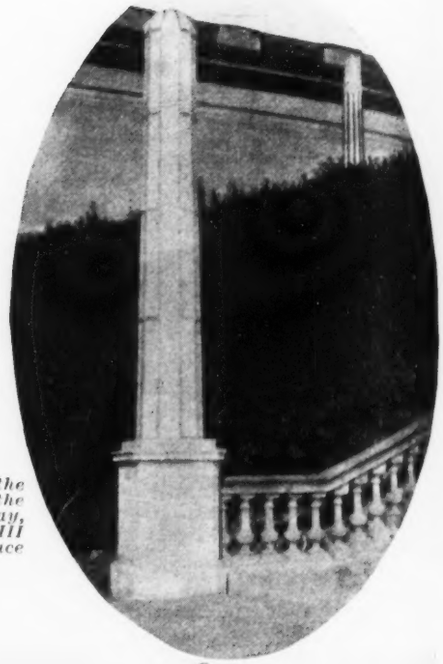


Fig. 8—At the Foot of the Stairway, Alfonso XIII Palace

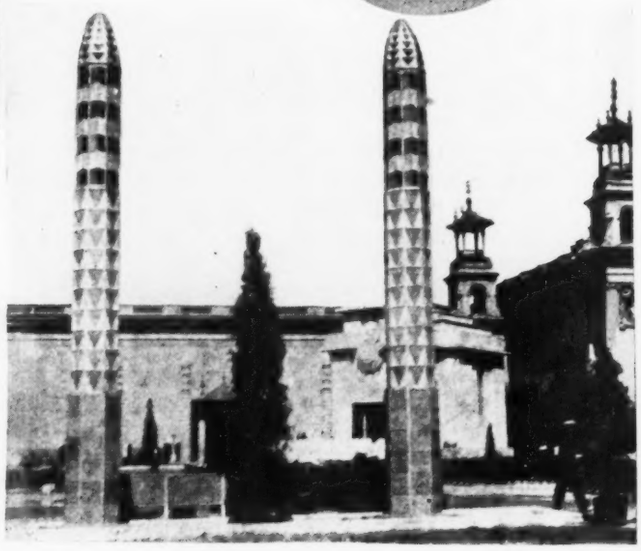


Fig. 9—A Triangulated Motif

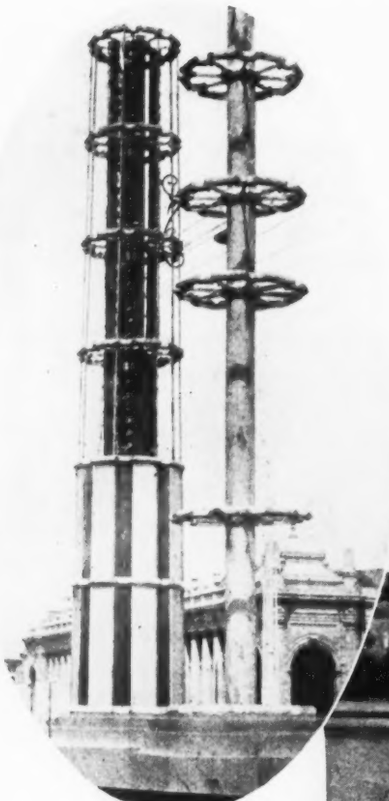


Fig. 7—Horizontal Disks Mounted on Center Pipe Support Colored Glass Panels

Fig. 10—Curved Sheets of Glass Decorate Column Base

are illuminated by specially designed under-water units, which throw lights on and through the water.

Applying these ideas to practice was a very serious problem, considering that the total energy required for the illumination was 5,232 kw. It was virtually impossible to regulate the current by direct means, as it would have meant using cable of inadmissible cross-section and control apparatus of extraordinary dimensions.

Several firms were consulted. The Westinghouse Electric & Manufacturing Company proposed a scheme of controls and specially designed lighting units which permitted the realization of the entire program by comparatively simple means. This proposition was accepted by the exposition engineers.

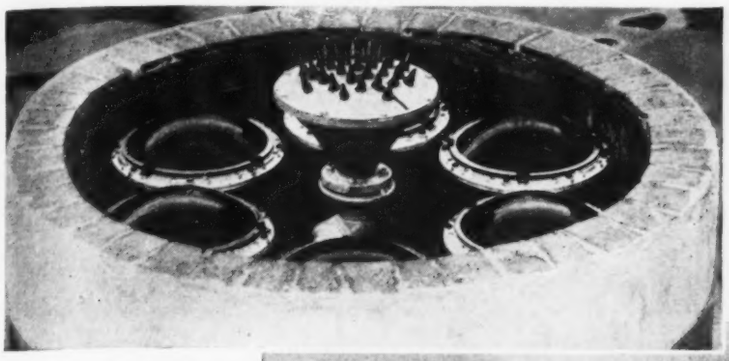


Fig. 11—Arrangement of 1,500-Watt Under-Water Units for Fountains

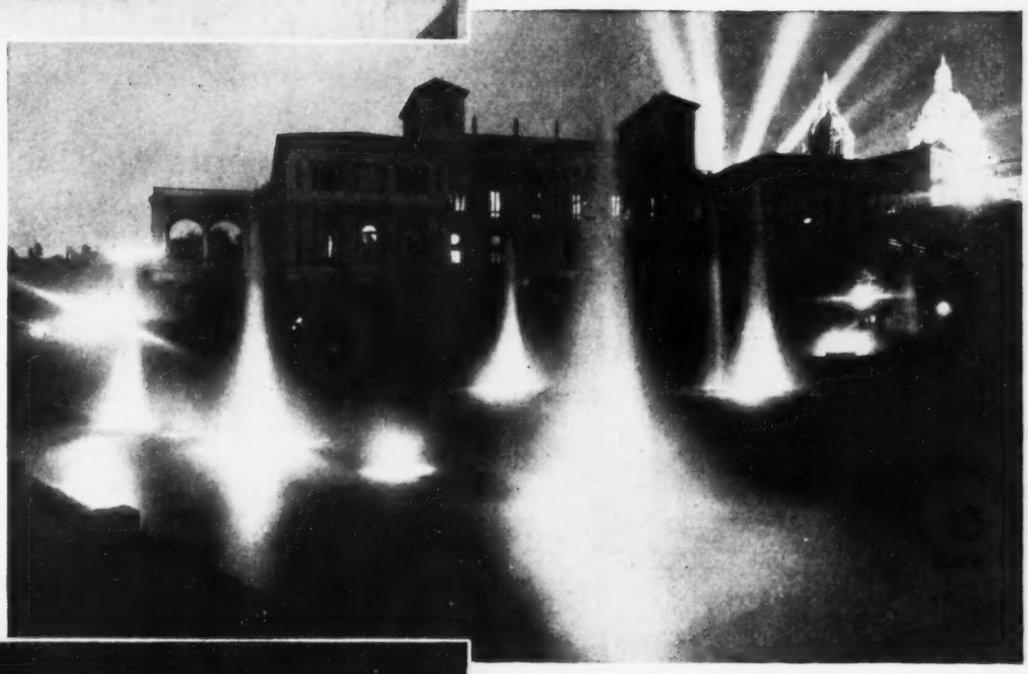


Fig. 12—Constantly Changing Lighting Effects in White, Yellow, Red and Blue Automatically Controlled

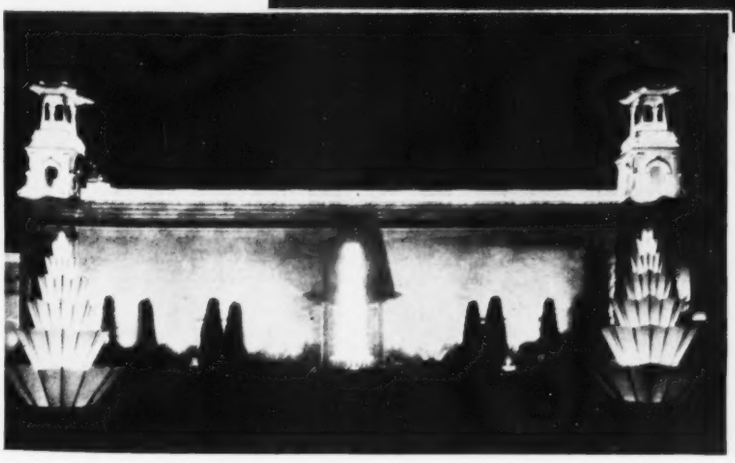


Fig. 13—Crystal Elements in Front of Reina Victoria Eugenia Palace

Indirect control using small pilot wires and reactor type light-intensity regulators formed the basis of the scheme. The reactors look very much like three-phase transformers, with the exception that the two outside coils are connected in series with the alternating-current lighting circuit. The center coil is independent and connected to a direct-current circuit.

When no current flows in the direct-current coil the two alternating-current coils interpose a high impedance in the lighting circuit. When current passes through the direct-current coil the flux in the transformer core will increase and, upon reaching saturation, will prevent the outer coils acting as reactors. Between these extremes any intermediate degree of brilliancy may be obtained. Since the current required by the direct-current coil is very small, small rheostats and fine wires can be used to control a very large amount of power.

Reactors ranging from 16 kw., 125 volts, air insulated, to 200 kw., 6,000 volts, oil insulated, are used in this installation. They are grouped into three substations and five manhole stations near the centers of distribution. All the direct-current pilot wires from these stations terminate in a central control station in a tower at the Plaza de España. From this vantage point the operator

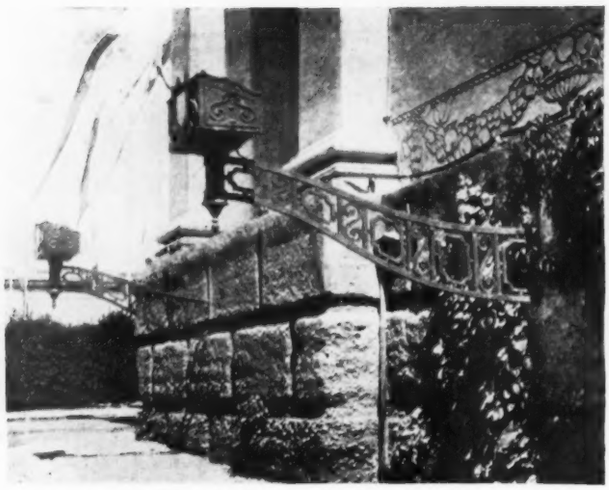


Fig. 14—Bracket Units Illuminate Façades of Alfonso XIII Palace

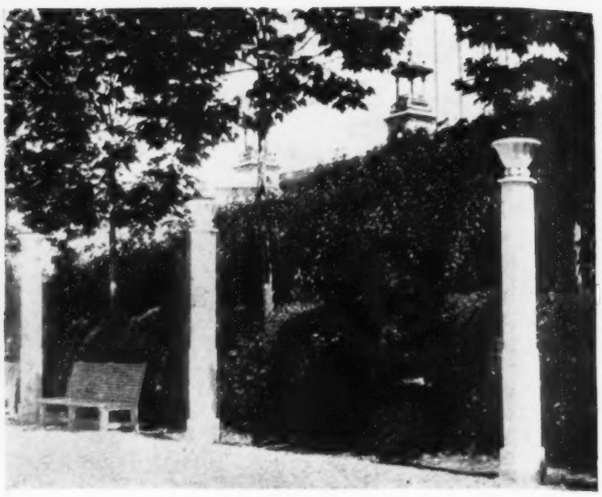


Fig. 15—Lamps in Tops of Such Posts Illuminate Foliage Around Great Fountain

has a full view of the exposition and lighting effects.

In the center section of the exposition flowing down from the National Palace are several cascades of water. Below these is a great fountain playing a stream of water 200 ft. in the air. Electric pumps circulate a total of 200,000 cu.m. of water per day through the cascades and fountains. The cascades and fountains are illuminated by specially designed under-water units which will throw lights on and through the water.

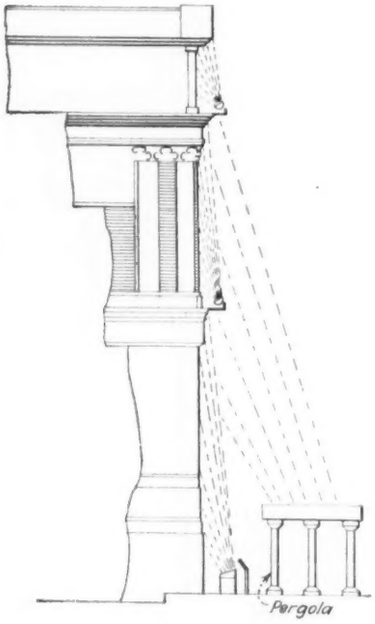


Fig. 16—Arrangement of Units for Illuminating Façades of National Palace

The top of each unit is covered with paneled glass below which are 2,000-watt lamps provided with reflectors.

For other parts of the decorative area a number of crystal elements of artistic design have been used. The crystal elements in front of the Reina Victoria Eugenia Palace each contain 200 50-watt lamps, divided in four colors—white, yellow, red and blue. To illuminate the lower part of the National Palace special units are located behind a hedge. The upper part of the building is illuminated by floodlights in cornices. Parts of the building, such as the entrance, etc., which could not be illuminated in any other way, were lighted by units in the top of specially designed pergolas. The towers are floodlighted by units on the roof. This is probably the first attempt of illuminating engineers to apply so vast an exterior lighting layout with centralized control.

Outputs of Electric Furnaces*

THE accompanying table gives the approximate output of product in pounds per kilowatt-hour for various electric furnace applications based on continuous operation. It should be kept in mind that these are average figures and special conditions may cause them to vary considerably from the actual results.

For application such as carburizing and continuous vitreous enameling the net economy will depend upon the ratio of the weight of work to the weight of boxes or tools; therefore, in the table the economies for these applications are based on the gross weights. Knowing the ratio of work to boxes or tools, the net economy can be determined.

Thus assume that 900 lb. of steel parts are to be hardened per hour in a box type furnace at 1,500 deg. F. From the table we can expect an economy of approximately 9 lb. per kilowatt-hour. Therefore $\frac{900}{9} = 100$ kw.-hr. will be required per hour. The rating of the furnace should be about 15 per cent above the actual requirements, therefore the rating of this box furnace should be about 115 kw.

**As indicated in a paper, "Calculation and Operating Costs of Electric Furnaces," presented by K. M. Cherry of the General Electric Company at the Industrial Electric Heating School, Case School of Applied Science, Cleveland, Ohio.*

Output of Various Electric Furnaces

Process	Temperature, Deg. F.	Type of Furnace	Economy in Pounds per Kw.-Hr
Drawing	600	Batch or continuous	20 to 35
		Continuous counterflow	30 to 50
Galvanizing	850	Batch or continuous	15 to 22
Copper annealing	1000	Batch or continuous	15 to 28
		Continuous counterflow	30 to 50
Brass annealing	1200	Batch or continuous	15 to 25
		Continuous counterflow	25 to 40
Steel annealing	1500	Batch or continuous	7 to 11
		Continuous counterflow	10 to 15
Hardening	1500	Batch or continuous	7 to 11
Vitreous enameling sheet steel	1550	Batch	3 to 6
		Continuous counterflow	15 to 20 (gross)
Cast iron	1350	Batch	6 to 11
		Continuous counterflow	15 to 25 (gross)
Steel casing annealing	1650	Batch	8 to 19
Carburizing	1650	Batch or continuous	4 to 11 (gross)

Electric Iron and Steel Melting Performance

From Western Society of Engineers' Hunt Award paper for 1929 by Delton T. Waby

INSTALLATIONS USING GRAPHITE ELECTRODES

Size of Furnace (Tons)	Capacity, Kva.	Voltage at Furnace	Type of Lining	Hours per Day	Tons per Month	No. of Charges per Month	Time Charge per Hour	Kw.-Hr. per Ton	Pounds of Electrodes per Ton	Product
25	10,000	100–85	Basic	42	3,780	120	6	525	10.5	Alloy steel ingots
25	10,000	100–85	Basic	24	3,780	120	6	525	10.5	Alloy steel ingots
10	2,500	190 with taps	Basic	24	1,000	100	4–6	650	8.0	Alloy steel ingots—five units in plant
7.5	3,000	100–85	Basic	24	1,260	150	4.5	600	12.5	Alloy steel ingots
6	1,500	100	Basic	24	1,070	144	4	625	11	Steel valve castings and fittings
6	1,920	130–90	Basic	10–12	640	80	2.2	592	9.5	Manganese steel castings, up to 10 tons
6	2,100	120–90	Acid	8–12	416	58	3	590	...	Miscellaneous steel castings—marine and tractor
6	2,300 1,900 1,000	180–154–109	Basic	24	1,059	141	3	600	9.5	Miscellaneous steel castings—railroad work
5			Acid	8.6	191	42	2.5	550	11	Miscellaneous steel castings—1 lb.-4.6 tons
3	1,000	120–80	Basic	10	240	64	2.86	660	9.2	Manganese steel castings 100 lb. and above
3	1,650	165–80	Basic	4–10	300	75	2.5	760	14	Valve castings and fittings
3	900	138–80–60	Acid	8	315	165	1.5	550	7–9 lb.	Miscellaneous manganese steel castings
3	900	138–80–60	Acid	8	315	165	1.5	550	7–9 lb.	Miscellaneous manganese steel castings
3	1,300	100	Basic	12	200	50	5.0	625	...	Locomotive castings
3	1,000	110	Acid	8–24	...	...	3.0	564	5.5	Miscellaneous steel castings up to 8,000 lb.
3	1,500	138–230	Acid	12	648	129	2.0	500	5.08	Miscellaneous steel castings
3	1,650	180–140–90	Basic	24	640	160	4.0	600	11	Steel ingots
3	1,290	130–90	Basic	10–12	360	80	1.5	590	9.5	Manganese steel castings
3	1,290	130–90	Basic	10–12	350	80	1.5	590	9.5	Manganese steel castings
2	1,500	225	Acid	6	450	200	1.25	600	9	Miscellaneous steel castings
2	750	230	Acid	8	300	120	2.0	600	4.0	Steel valves and fittings
1.5	800	120–90	Acid	8–16	100	50	...	625	...	Miscellaneous steel castings
1.5	...	115	Basic	18	87	29	1.5	617	16	Truck work and miscellaneous manganese castings
1.5	800	90–45	Basic	10	247	93	1	517	22	Miscellaneous carbon—manganese steel
1.5	1,400	132–76	Acid	10	525	200	1.3	575	12	Railway work
0.75	350	175	Acid	24	265	290	1.2	525	6.0	Miscellaneous steel castings
0.5	450	180–70	Basic	Varies	67	160	1.0	725	Varies	Alloy steel castings
0.5	350	150–50	Acid	24	40	50	2.0	700	10	Miscellaneous steel castings average 20 lb.
0.5	350	Variable	Acid	8	208	156	0.66	602	3.5	Cast iron
...	...	...	...	...	49	304	0.83	580	9.03	...
3	1,500	105	Acid	24	6,000	2,600	4.6 min.	105	5.5	Malleable iron
3	1,500	105	Acid	24	7,000	2,800	4.6 min.	115	6	Duplexing

INSTALLATIONS USING CARBON ELECTRODES

6			Basic	8.6	339	40	4.5	644	23.3	Steel castings—100 lb. and above
6	1,200	100	Basic	24	889	119	4.5	640	25.0	Steel castings
6	1,200	100	Basic	24	899	119	4.5	640	25.0	Railroad work—1–500 lb.
3	1,500	140–100	Basic	24	1,400	240	2.25	615	19.8	Miscellaneous melting
3	1,500	140–100	Basic	24	1,400	240	2.25	615	19.8	Steel castings
3	1,500	120	Acid	10	800	196	1.75	545	11.0	45 lb.—average steel castings
3	1,500	120–80	Acid	24	980	280	1.75	630	15.0	20 lb.—average steel castings
3	1,200	120	Acid	24	450	136	1.50	600	18.0	Steel castings, automobile and truck parts
3	1,650	180–140–90	Basic	24	640	160	4.0	600	17.0	Steel ingots
2	500	110	Acid	10	...	...	2.0	600	16.5	Miscellaneous steel castings
2	500	110	Acid	10	...	...	2.0	600	16.5	Miscellaneous steel castings
2	1,500	140–100	Basic	24	1,200	240	2.25	680	26.4	Carbon steel castings
2	1,000	140	Acid	20	307	139	1.50	540	...	Miscellaneous steel castings
2	1,000	140	Acid	20	307	139	1.50	540	...	Miscellaneous steel castings—light class
1.5	1,200	138–230	Acid	16	668	211	2.0	525	11.3	Miscellaneous steel castings
1.5	800	125	Acid	9–10	250	100	4.5	600	...	Steel castings less than 80 lb.
1.5	1,000	120	Acid	10	306	123	1.75	580	12.0	Steel castings—45 lb. average
1	750	130	Acid	16	250	167	1.33	580	13.5	Miscellaneous steel castings
...	1,500	96	Acid	22	2,500	...	Cont.	130	8	Malleable iron—85 per cent automobile parts
...	1,500	96	Acid	22	2,500	...	Cont.	130	8	Malleable iron—85 per cent automobile parts
...	1,250	96	Acid	22	2,500	...	Cont.	130	8	Malleable iron—85 per cent automobile parts

Outlet Voltage Important in Lighting Costs

THAT lamp and supply voltages should be closely related is clearly indicated in the accompanying tabulation, prepared by T. S. Merrill, National Lamp Works, Cleveland, Ohio. Low voltage at the lamp socket, due to inadequate wiring capacity on the customer's premises, is often difficult and expensive to change in old buildings, but the selection of lamps of a rating which will match the voltage at the socket will prove advantageous, Mr. Merrill points out, in reducing the cost of lighting.

Undervoltage burning assumed to be due half to difference between lamp voltage and service voltage (voltage at meter) and half to voltage drop in interior wiring with a minimum drop of 3 per cent.

Cost of light figured for case as follows: 200-watt lamps cost 75 cents installed in socket (this would represent purchase under a $600 contract with a handling charge of 14.2 cents per lamp). Energy cost 3 cents per kilowatt-hour (this should include demand charges), 1,500 hours use per year. Fixed charges on interior wiring (interest, taxes and depreciation) 12 per cent per year. Mechanical breakage (one lamp each 10,000 burning hours) has been included.

Lighting Costs as Related to Socket Voltages

Volts Delivered at Socket in per Cent of Labeled Voltage of Lamp	Watts Consumed by Lamp —in per Cent of Rated Wattage of Lamp—	Watts Lost in Interior Wiring	Watts at Meter	Candle-Power Produced in per Cent of Normal Candle-Power of Lamp	Cost of Lamps Consumed in per Cent of Total Operating Cost of Lighting	Cost of Energy Consumed	Fixed Charges Interior Wiring	Total Cost of Operation Installation	Total Cost per Candle-Power in per Cent Cost per Candle-Power at 100 per Cent Voltage
80	70.9	8.9	79.8	45.4	1.1	63.1	4.6	68.8	151.2
85	77.9	6.9	84.8	56.7	1.7	67.0	5.3	74.0	130.5
90	85.0	4.7	89.7	69.5	3.0	70.9	6.4	80.3	115.6
95	92.4	2.9	95.3	83.9	5.6	75.3	8.0	88.9	106.0
100	100.0	3.0	103.0	100.0	10.4	81.4	8.2	100.0	100.0
105	107.8	3.1	110.9	117.7	19.2	87.6	8.5	115.3	98.0
110	115.8	3.2	119.0	137.2	34.9	94.0	8.7	137.6	100.2

Carrying Capacity of Cables

Based on heating and continuous rating, a graphical chart has been devised for cables in air, water or soil. Derivation of chart and how to use it

By THOMAS F. PETERSON
Cable Engineer American Steel & Wire Company

IN RECENT YEARS there has been a concerted effort on the part of various experimenters, engineering societies and industrial organizations to secure data—physical constants, thermal characteristics of cable, duct banks, soils, etc.—and to develop methods of computation of cable and duct heating.

These are praiseworthy endeavors because the information gathered should eventually assist in more economical design and layout of transmission and distribution systems and will allow of more accurate comparison of temperature and loading of cable.

Most important is the last, for, although economy, regulation and stability may at times determine the rating of cable, temperature limitations imposed by the type of insulation usually constitute the controlling factor.

—EDITORS.

THE maximum permissible temperature of copper in underground cables may be arrived at by judicious consideration of such items as deterioration of insulation, migration of compound, dielectric loss, etc. In the case of paper and lead cable it would appear, from tests recently reported, that the insulation may be maintained without deterioration at considerably higher temperatures than now set. However, repeated expansion and contraction of cable, swelling and development of permanent set in lead, creation of voids in insulation, etc., enter as determining factors. In view of the latter and since harmful effects of expansion are dependent on change in temperature, it would seem highly justifiable to specify a maximum range of temperature, together with the frequency of repetition and rapidity of change. Then, with lower limit dependent on installation (location and type), the upper limit would be determined, always, of course, being less than the maximum based on deterioration. Unfortunately it is difficult to arrive at any suitable values for the factors involved and, until something rational can be evolved, the present generally accepted upper limits of copper temperature will have to be used.

For rubber $T_c = 60 - \frac{E}{4}$ and for varnished cambric $75 - E$ degrees C are the values adopted by the A.I.E.E. In the case of paper this maximum temperature of copper varies from 60 deg. C. for voltages above 28 kv. to 85 deg. C. for low-voltage cable.* Recently the insulated power cable engineers have agreed to allow a maximum of $90 - E/\sqrt{3}$ (in which E is the working voltage) for type H cable.

From the foregoing it may be inferred, and rightly so, that there is available no small amount of data on the subject of cable carrying capacity. These are, however, in many cases of questionable value, inasmuch as different methods of application are in use and too few of the variables are given when values of constants are assigned. Moreover, the accuracy of constants and variable nature of same are not always viewed in the proper perspective.

CONTINUOUS CAPACITY CHART

It is believed that, though fine calculations of short-time rating and the like are permissible in some cases of large systems, when such are completed they may well be scrutinized before placing too much dependence on them. By far the greatest need today is a rationalizing of the data and methods available and the development of a method of computing carrying capacity which is conservative, can be used without exact knowledge of all the theory involved and which gives results of accuracy commensurate with that of the known constants and degree of control of operating conditions. To this end a chart has been prepared which should enable one not familiar with cable theory, but who nevertheless is called upon to operate systems, to determine what continuous rating may safely be assigned cables of various types, voltages and conditions of operation.

BASIS OF CHART

As has been pointed out, the maximum allowable copper temperature T_c for the insulation in question will be taken as the factor limiting the maximum loading of the cable. Knowing this and the temperature of base—that is, either earth, air, water or empty duct, together with the resistance to flow of heat—the amount of heat which can be dissipated, that is, carried away through the surroundings, can be computed. The cable loading which would develop this heat can then be ascertained. The fundamental law of heat conduction is analogous to that of the flow of electric current. The temperature drop is equal to the heat flow per second, $W \times$ thermal resistance H. For example, T in $°C = W$ (watts loss per duct foot) $\times H$ ($°C$ per watt). The thermal resistance of simple structures may be computed when the dimensions and thermal resistivity are known. As an example, the resistance of a block of insulation length l and cross-section area a, $= \rho \frac{l}{a}$. The resistance per foot of single-conductor cable $= \frac{\rho}{2\pi \times (2.54 \times 12)} \log_e \frac{R}{r}$ (1)

*See A.E.I.C. specification.

In this the resistivity ρ is given in degrees C per watt per cm^3.

In the case of bodies of insulation such as that of a cable between three conductors and lead sheath, though approximate formulas have been developed by Mie and Russell, for practical purposes, it is much more preferable to determine experimentally geometric factors for various types of cable. This has been done by Atkinson* and incorporated in charts by Simons. In the upper left hand quadrant of the accompanying chart such factors have been plotted in a way which enables one to determine their values for various types of cable, with different copper sizes and insulation thicknesses. The right hand axis is graduated in such a way as to give the form factor per foot of cable. The form factor F.F., when multiplied by the thermal resistivity of the insulation, gives the thermal resistance from copper to lead. In the upper right hand quadrant curves are given which accomplish this multiplication and enable one to determine the resistance of cables with various types of insulation, i.e., with insulation of various resistivities.

As an example, consider three single conductors in one duct. The resistance of one conductor per foot is given in the above formula (1). The resistance of three conductors to lead would be one-third of this value. The geometric factors plotted for three singles are equal to $\log_e \frac{R}{r}$

$$\text{Form factor F.F.} = \frac{\text{G.F.}}{3 \times 2\pi \times 2.54 \times 12} \qquad (2)$$

*A.I.E.E. Transactions, September, 1920.

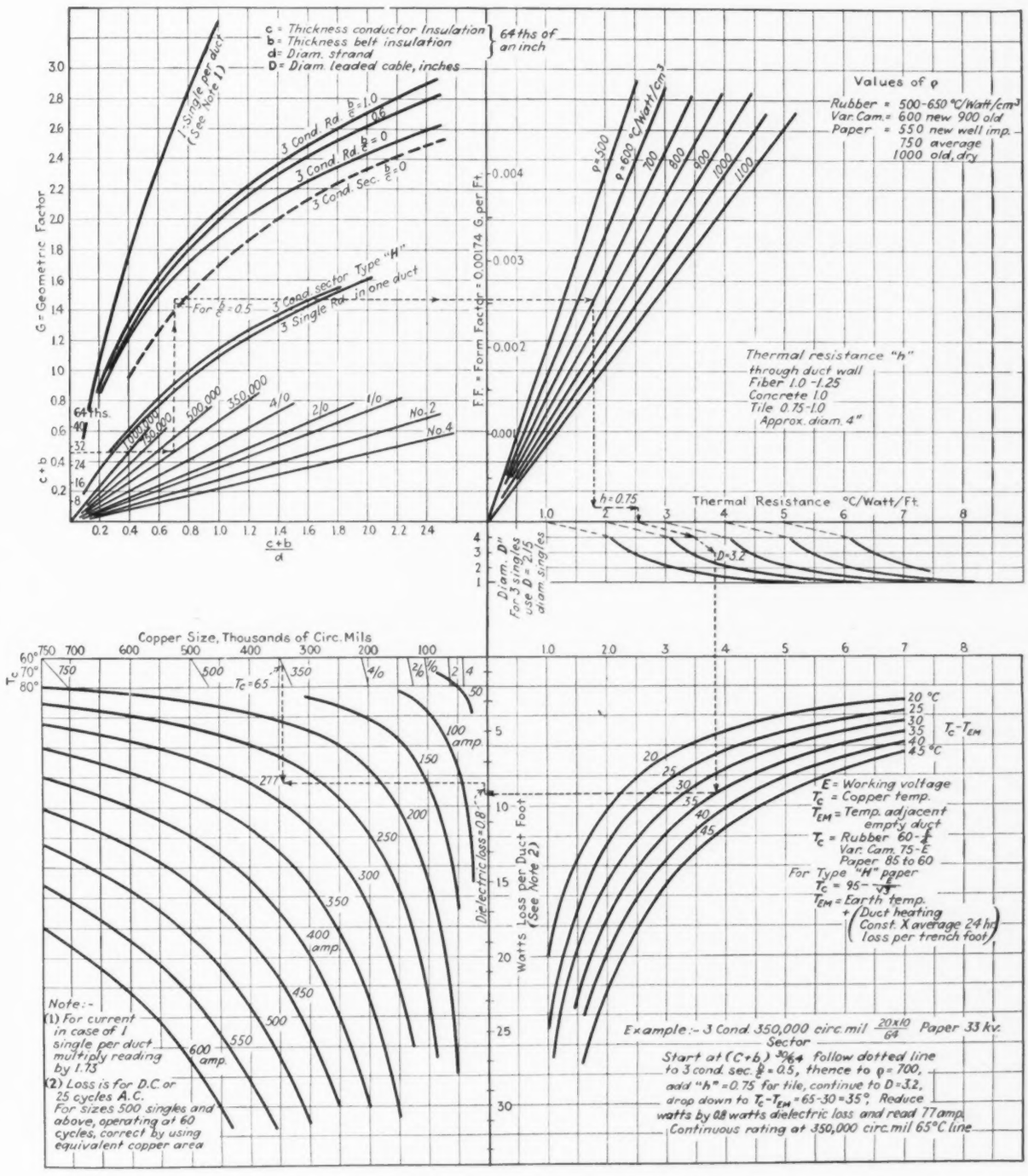

c = Thickness conductor Insulation
b = Thickness belt insulation
d = Diam. strand
D = Diam. leaded cable, inches
64ths of an inch
1 Single per duct (See Note 1)
3 Cond. Rd. b/c = 1.0
0.8
0.6
3 Cond. Rd. b/c = 0
3 Cond. Sec. b/c = 0
3 Cond. sector Type "H"
3 Single Rd. in one duct
For b/c = 0.5
G = Geometric Factor
c+b / d
64ths.
1000,000
750,000
500,000
350,000
4/0
2/0
1/0
No. 2
No. 4
F.F. = Form Factor = 0.00174 G. per Ft.
Values of ρ
Rubber = 500-650 °C/Watt/cm³
Var. Cam. = 600 new 900 old
Paper = 550 new well imp.
750 average
1000 old, dry
ρ = 500
ρ = 600 °C/Watt/cm³
700
800
900
1000
1100
Thermal resistance "h" through duct wall
Fiber 1.0 - 1.25
Concrete 1.0
Tile 0.75-1.0
Approx. diam. 4"
h = 0.75
Thermal Resistance °C/Watt/Ft.
Diam. D" For 3 singles use D = 2.15 diam. singles
D = 3.2
Copper Size, Thousands of Circ. Mils
Tc 60° 70° 80°
Tc = 65
Dielectric loss = 0.8 Watts Loss per Duct Foot (See Note 2)
100 amp.
150
200
250
300
350
400 amp.
450
500
550
600 amp.
277
Tc - TEM
20 °C
25
30
35
40
45 °C
E = Working voltage
Tc = Copper temp.
TEM = Temp. adjacent empty duct
Tc = Rubber 60-E Var. Cam. 75-E Paper 85 to 60
For Type "H" paper
Tc = 95 - W
TEM = Earth temp. + (Duct heating Const. X average 24 hr. loss per trench foot)
Note:-
(1) For current in case of 1 single per duct multiply reading by 1.73
(2) Loss is for D.C. or 25 cycles A.C. For sizes 500 singles and above, operating at 60 cycles, correct by using equivalent copper area
Example:- 3 Cond. 350,000 circ. mil 20x10/64 Paper 33 kv. Sector
Start at (C+b) 30/64 follow dotted line to 3 cond. sec. b/c = 0.5, thence to ρ = 700, add "h" = 0.75 for tile, continue to D = 3.2, drop down to Tc - TEM = 65-30 = 35°. Reduce watts by 0.8 watts dielectric loss and read 77 amp. Continuous rating at 350,000 circ. mil 65°C line

Fig. 1—Cable-Carrying Capacity Chart

Following the dotted line on the two upper quadrant charts gives the thermal resistance of the insulation, to which is added the resistance of the duct used. Curves in lower right hand quadrant determine the watts loss that may be dissipated and those in the lower left-hand quadrant give the watts loss per foot of cable when various values of current flow through the three conductors.

From a comparison of formulas (1) and (2) it follows that "Thermal Resistance" $H = \text{F.F.} \times \rho$. It should be observed that, in making the curves applicable to both "one single" and "three singles or three conductor" per duct, the $\frac{1}{3}$ multiplier introduced between geometric factor and form factor necessitates plotting $3 \log_\epsilon \frac{R}{r}$ as geometric factor for "one single" per duct. The true factor for a single-conductor cable is given by the curves labeled "3 singles, Rd., in one duct" and $= \log_\epsilon \frac{R}{r}$.

Taking now, for consideration, the case of cable installed in subways of various numbers of ducts, the first step will be to determine the temperature of an empty duct into which it is assumed the cable will be placed. No attempt will be made here to go into the details of making this computation. Suffice it to say that such temperature will be dependent on the average loss in the subway over 24 hours and a heating constant which is dependent on the position of the duct in the bank, the type of subway and the condition of surrounding soil. Knowing these

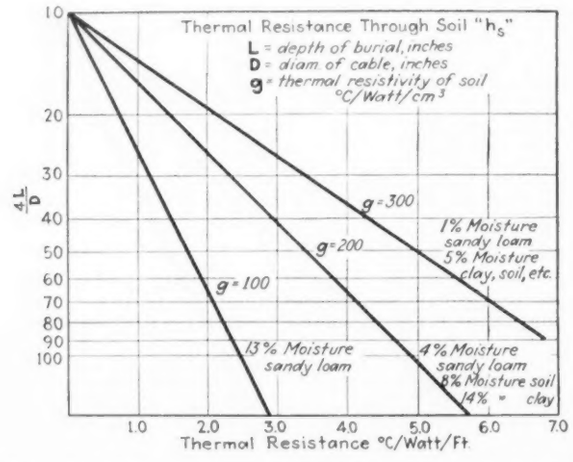


Fig. 2—Correction Chart Permits Applying Fig. 1 to Buried Cables

For cables buried in soil it is necessary to use the factor h_s, thermal resistance through soil, instead of radiation factor and thermal resistance through duct as given in Fig. 1. If no correction is made for thermal resistance of jute, etc., substitute D = diameter of leaded cable.

conditions, it is possible to compute the temperature drop from the empty duct to the earth temperature. Adding this drop to the value of earth temperature as given by curves or other data for the depth of subway in question, the empty duct temperature is obtained.

By far the most satisfactory method of arriving at this temperature is to conduct a survey and make actual measurements. In so doing all of the extremely variable and unknown quantities, such as earth condition and temperature, thermal resistance of subway, total loading of subway, loss and load factor, local heating, etc., may be circumvented and the combined effect of all of these characteristic conditions may be ascertained. This procedure is recommended not only to the inexperienced, but also to others who may use the data obtained in checking computations and in providing constants for the particular ducts and subways for use in future calculations.

The difference $T_c - T_{em}$ is the drop available for heat flow from the copper conductors through the insulation of cable, through the air in the duct and then through one duct wall.

By following the dotted line in the chart through the first and second quadrants the thermal resistance of the insulation is obtained. To this is then added the resistance for the duct in question, that is, h. It will be noted that the values given indicate better conductivity for tile and concrete than for fiber in concrete. This is in line with certain observations of Knipmeyer's. To the thermal resistance already obtained must be added an equivalent resistance per foot of duct corresponding to the drop in temperature for radiation from the lead sheath. The curves giving these resistances as a function of cable diameter are based on an emissivity of 1,050 deg. C. per watt per cm². This is the value for dull lead when the loss is approximately 11 watts per foot and cable diameter approximately 3 in.

Assuming now that the value of T_c and T_{em} are known, the curves in the lower right hand quadrant merely accomplish division of the difference between the temperatures by H and give the watts loss which may be dissipated.

The curves in the lower left hand quadrant give the watts loss per foot of cable when the various values of current flow through three copper conductors. These losses include correction factors for stranding of copper, cabling of individual conductors into multiple conductor cable and temperature. The last mentioned is obtained by assuming a reduction in copper area when the temperature of operation is in excess of 60 deg. C. The watts loss which it is possible to dissipate includes not only the resistance loss in copper but also the dielectric loss and the sheath current losses. Therefore, before the current can be determined it is necessary to deduct the last two mentioned prior to obtaining the current which would give the copper loss which can be handled.

The uses of the curves will be more readily understood and appreciated if in addition to the supplementary notes on the sheet the following points are observed: To get the carrying capacity of any cable, follow the dotted line starting from $c + b$ equal to the insulation thickness and continuing up to the form (or geometric) factor curve. It should be carefully noted that for sector conductor belted cable with $\frac{b}{c}$ equal to a fraction, an addition must be made to the form factor of the same amount as that indicated for the corresponding round conductor cable.

Since the watts loss is given for three conductors, when dealing with a single conductor in one duct or in air, the current must be increased until the loss is three times as great as that arrived at by following the curve sheet; that is, the current must be multiplied by the square root of 3 equal to 1.73. For single conductors greater than 750,000 get the current I for a copper section of one-half the area in question and multiply the value obtained by the square root of 2 equal to 1.42 and as above by 1.73. It should be observed that, in the case of very large conductors operating 60 cycles, skin effect alters resistance and so an equivalent cross-section area should be used in obtaining watts loss for any current. For standard stranding and 60-cycle operation make the following reductions to get equivalent area: 2,000,000 circ.mil, 19.3 per cent; 1,500,000 circ.mil, 12.7 per cent; 1,000,000 circ.mil, 6.3 per cent; 600,000 circ.mil, 2.5 per cent.

Chart Adaptable to Cables in Air, Soil or Water

With but a few modifications, the chart is readily adapted to computation of carrying capacity of cable in air, buried in the ground and in water. For cables in air, follow the chart precisely with the exception of the inclusion of duct resistance h. Substitute the temperature of air in place of the temperature of the empty duct. When cable is buried in the ground, instead of adding to the thermal resistance of the insulation, the factor h and the radiation factor correspond to cable diameter, add h_s as given on the supplementary sheet and determined for the particular values of L and D in question, L being the depth of burial and D the diameter of cable. These curves are based on the formula for the thermal resistance of soil $\frac{g}{2\pi} \log_\epsilon \frac{4L}{D}$. Unless the resistance of the armor and jute is included in the computations and added to h_s, use D = diameter of the leaded cable. Doing the latter involves making the assumption that thermal resistivity of armor and jute is equal to that of soil. Though this is not exactly so, the error introduced will not be serious.

In the case of submarine cable it is quite obvious that no additional factor, such as h for radiation, need be added to the thermal resistance of the insulation. Braided cables may be handled as lead cables except that the thermal resistance of the braid must be included and may be taken as being equal to $\frac{300\,t}{D_b \times 12 \times 2.54}$ t and D_b same units, and in obtaining the equivalent thermal resistance for radiation, use $D = 1.56 \times$ diameter of braided cable. The latter is on the basis of an emissivity constant of approximately 700.

In connection with the radiation factor it is to be

noted that when three single conductors are placed in one duct the diameter used for determination of resistance is equal to 2.15 × the diameter of the individual conductor. The reason for this is that though the equivalent diameter of three singles, as far as radiation is concerned, should be somewhat less than the diameter of the circumscribed circle, usually the watts loss for three singles per duct foot is considerably greater than for multiple conductor cable and so, with the higher watts loss, the effect of the decreasing emissivity constant must be taken into account. This lowered emissivity constant with greater watts radiated per unit area is compensated for by using the circumscribed circle diameter instead of a somewhat smaller equivalent diameter of radiating surface.

Accurate for Practical Purposes

In the above an attempt has been made to cover most types of cable dealt with in practice, whether installed in ducts, air, water or buried and regardless of the copper size, insulation thickness or ambient temperature. While it might be argued that the graphical methods are not as accurate as mathematical computations, it is felt that in the case at hand they are well within the range of accuracy of the constants given. Moreover, the operator is brought into full cognizance of the significance of errors in various parts. The methods used are based on the works published and unpublished of Atkinson, Simons, Kirke, the author and others. Numerous checks have been made where possible in an attempt to determine to what extent dependence may be placed on the chart. The results were, to say the least, quite gratifying so far as agreement was concerned.

Men and Machines

By F. H. Miller

Vice-President Hoosier Engineering Company

MANY improvements have already been made, and many more certainly will be made, in methods and machines employed in transmission line erection. Progress in mechanization is truly important, but it is less important than improvements in the organization of man power for the job. *Men are always more important than machines.* Transmission line building is the same as any other kind of major construction; anything that confuses the organization or that in any way interrupts the continuity of the work is costly. In such situations there is more to be expected from intelligent men than from any machines, however near perfection they may be.

Football at Night Attracts 25,000 Spectators

NIGHT football has proved highly successful from the standpoint of both the spectator and player in the newly lighted Rose Bowl at Pasadena, Calif. High school football games, formerly attended by only a few thousand when played in the afternoon in competition with intercollegiate games, now draw as high as 25,000 spectators. Three steel masts are mounted on each side of the bowl. Eight 1,500-watt projectors are mounted on each center support and six similar projectors on each of the others, making a total of 40 lights in all. Lighting intensity on the field is maintained at 8 foot-candles to a height of 50 ft. above the field. The cost of the installation amounted to approximately $16,000.

Letters from Our Readers

Economics Should Determine Submetering Decision

To the Editor of the ELECTRICAL WORLD:

It seems to me that the problem stated in the article "Submetering—A Menace," which appeared in the ELECTRICAL WORLD for October 9, is one of economics. If submetering companies can furnish, maintain and read meters, bill and collect accounts, etc., at less cost than can the utilities themselves, then these companies should take over this part of the utility business. Where there appears to be merit in the claims that the submetering companies can serve cheaper, the situations are caused, I believe, by inadequate rate structures, and as such should be corrected by the utilities themselves rather than be met by the edicts issued by courts or utility commissions.

Let us consider the following points in regard to submetering that are directly associated with the rate structure.

1. Can a utility perform the functions of metering, billing, etc., at a lower actual cost to building owners and tenants than can a submetering company which assumes those functions?

2. If the utility can supply wholesale service to the owner at a profit and it also can supply the meters and perform the work done by a submetering company for less cost than can this company, is it not proper to question why the utility does not adjust its rate structure so that it can serve the tenants direct and give to the building owner the energy he requires for building services at a total actual cost to both less than what they pay with the submetering company in the picture?

3. Consider the problem from the standpoint that the difficulty is the result of retail rates to present customers being based either on "the value of the service to the customer" or "the apportionment of the delivery cost on the basis of the average number of customers per mile of distribution line without including tenants of large office buildings in the number of customers." For example, if the delivery costs are apportioned in New York City on, say, an average of 200 customers per mile and the rates obtained were applied to the individual tenants of a building, who as consumers might have a density of 200,000 per mile, it is quite evident a very large profit would be made from those tenants. The amounts collected from the tenants and the building owner based on a 200-consumer density would be greatly in excess of the combined production and delivery cost and the cost of metering, billing and collecting. Have not the submetering companies simply taken advantage of a weakness in rate structures and made their profits from the fact that building tenants are not included in consumer density calculations?

4. If a large office building were so wired that one meter could be installed on the entire building, one meter on all the tenants, an individual meter on each tenant and one meter for all uses in the operation of the building and the distribution cost and fair returns duly analyzed, would it not be possible to work out cost data by which the errors in present rate structures for such business could be uncovered and rates found that would eliminate submetering by proving its economic fallacy?

It seems to me that the menace of submetering would not remain a menace if the rate structures of many utilities did not contain the fallacies always inherent in averages derived from data in which great differences exist between maximum and minimum values. That is to say, a rate schedule that attempts to cover too much of the scale of consumer classification must be in considerable error at the extremes of its range. The error is so large in the case of low density rates applied to a high density classification, i.e., to owners and tenants of office and apartment buildings, that there is ample opportunity for a third party to enter the situation and take a profit from it.

W. J. GREENE,
Rate Department.
Iowa Railway & Light Corporation,
Cedar Rapids, Iowa.

Tribute to Etienne de Fodor

To the Editor of the ELECTRICAL WORLD:

Etienne de Fodor, who passed away at Budapest, Hungary, on November 5, 1929, at the age of 73 years, was, like J. W. Lieb and myself, one of the few Edison pioneers who retained their positions with the foreign Edison companies for more than ten years.

Fodor came to the French Edison Company early in 1881 and did good work in helping Charles Batchelor during the great Exposition International of Electricity in Paris, 1881. There he took part in those Edison tests at the Grand Opéra in Paris, and which turned the tide completely in Edison's favor.

Fodor erected the first Edison plant in Europe at Strasbourg and then helped us in starting the French Edison Works in Ivry-sur-Seine, near Paris. He did good work in Belgium and Holland, and Edisonized Russia with Edison plants. He also erected plants in France, Algeria, Greece, Turkey and Hungary.

After he had erected the Edison three-wire central station in Athens, Greece, he received an offer to take charge of the direct-current central station at Budapest. His energy and skill soon led him to become the general manager and director of his company and he retained that position for more than 25 years.

He was a self-made man, an excellent engineer, electrician, linguist and technical writer (he wrote the first book on the incandescent lamp and Edison system in 1882, which was published in Vienna in the year 1883).

There existed no more stanch Edison pioneer than Fodor, and every year on February 11 (Edison's birthday) he gave a dinner in celebration of the event in Budapest, and his life's aim was to inculcate Edison ideas and principles in his country, in which I helped him for more than twenty years. He was a hard and earnest worker, yet never shunned the good things of life, and saw it from every angle (a sort of Humphry Davy). When Edison came to Budapest in 1911 with his family Fodor gave him a rousing reception, such as Budapest had never seen.

During the war he suffered, and when the Bolshevists got control he was thrown into jail for his loyalty to his country. In the garden of his residence they placed a large bust of Lenin, as a red shrine. He often contributed to the ELECTRICAL WORLD. He received a grave of honor from the city of Budapest and many foreign decorations were bestowed on him for his efforts in electricity. He was one of Hungary's greatest public utility men.

FRANCIS JEHL.
Dearborn, Mich.

Digest of Foreign Literature

Hydro-Electric Development and Steam Equipment

Slacks Valley Power Station.—The new Slacks Valley power station is notable not so much for its size as for being representative of current English practice. The present capacity of the station is 37,500 kw., although planned for an ultimate load of 150,000 kw. Conspicuous among the features of this new plant are the expedients which it was necessary to adopt in the construction of the foundation and the provision for the handling of fuel and ashes. A general description of this recently completed plant is offered.—*Electrician (England)* November 1, 1929.

Generation, Control, Switching and Protection

Effect of Low Temperature Upon Circuit Breakers.—O. GRAUL.—Oil circuit breakers for outdoor installation are usually filled with a low freezing point oil, to insure proper operation even on coldest days. German VDE rules prescribe an oil with a jel-point of minus 40 deg. C. However, even for such oil, the viscosity rises considerably at customary winter temperatures of zero to minus 20 deg. C. If a circuit breaker is designed with only a small margin of extra power in its opening springs a marked decrease in opening speed with greatly reduced rupturing capacity will result on cold days. It is stated that essential points for a serviceable breaker are: Strong but very light crosspiece, heavy springs with plenty of reserve power and stream-lined shape of crosspiece. Breakers, so designed, filled with low jel-point oil have nothing to fear, according to the author, from extremely cold weather, and will function well without heating units installed in the breaker tanks.—*Elektrotechnik und Machinenbau*, October 27, 1929.

Illumination

Industrial Lighting for All Requirements.—In order to secure an adequate consideration of the problem of satisfactory industrial lighting, this study has been divided into the classes of general or overhead lighting, group or localized general lighting, and local lighting. A number of recommendations for specific intensities of light and work have been included and the extreme importance of maintenance in good lighting work has likewise been brought to the attention of the reader. In listing the six principal causes of lighting depreciation there have been listed: Dirty reflectors and lamps, darkened walls and ceilings, lamps of poor quality, empty sockets and unobserved burnouts, undervoltage burning of lamps, and improper combination of lamp and reflector. It is stated that in one installation it was found that the oily atmosphere had blackened the units and reduced the illumination considerably. Photometric readings were taken on the working plane and showed 2½ foot-candles. The units were washed and readings were again taken showing 12½ foot-candles. This extreme condition not only gave the workers one-fifth of the light specified but also meant an absolute waste of 80 cents out of every dollar spent for electric current and lamp renewals.—*Electrical News and Engineering (Canada)*, November 1, 1929.

Designing Station Lighting.—C. B. STEPHENS.—A consideration of the important factors and the requirements to be met in generator rooms, control rooms, switchgear rooms and outdoor switch structures. The author has endeavored to outline the modern trend in station lighting and to emphasize the type of fixture and placement best conducive to good results. Operating requirements are such as to indicate the necessity for the avoidance of shadows, particularly for switching operations. In order to offer a complete analysis of the subject the interior finish on the walls has been considered an essential element of the illumination problem and so treated. Adequate wiring has also been given consideration in this discussion.—*Electrical News and Engineering (Canada)*, November 1, 1929.

Transmission, Substations and Distribution

Reaction of Static Condensers Upon the Network.—M. HURBIN.—A static condenser, connected to a load to improve its power factor, causes resonance with the inductive part of the load and distorts current and voltage waves. The general magnitude of induction in a network is of such an order that resonance can only occur with higher harmonics. The author investigates this problem mathematically, with vectors, with loop oscillographs and cathode-ray oscillographs, to find the highest possible amplitude of resonance in practical service, and comes to the conclusion that overvoltages caused by it can never reach values which might endanger customary insulation. The distortion of the voltage wave is essentially restricted to the condenser and its transformer, the leakage inductance of which furnishes the inductive component. No distortion is transmitted to the high-voltage side of the transformer. Data are given on inrush and on losses in the condenser due to excess currents. The author also investigated the influence of distorted wave shapes upon the indication of measuring instruments and meters.—*Bulletin de l'Association Suisse des Electriciens*, October 7, 1929.

Heat Applications and Material Handling

Annealing of Metals.—G. KELLER.—For many years past it has been customary to anneal wires and steel punchings for electric machines in large, heavy cast-steel pots. All of the many disadvantages of this antiquated method are overcome by a new principle advocated and described by the author. Instead of filling a pot with the raw material, the goods are stacked on a base plate to which is attached a cover. This structure is then lifted into a cylindrical steel pot, made from ¼-in. boiler plate, which is surrounded by a cylindrical pit, in which are arranged sets of electric heaters. The cover is held tightly to the steel container by means of a rubber gasket, cooled by a water trough. The oxygen contained in the pot is rapidly consumed by the oxydization of oil and grease on the punchings, so that before oxydization temperature of the steel is reached all of the oxygen has been removed. After the material is fully annealed the pot is taken out of the electric oven and is allowed to cool, during which procedure a vacuum of 400 mm. of mercury is formed. Depending upon whether black, blue or bright annealed steel is desired, this vacuum is broken sooner or later. A thermocouple-actuated control makes the entire annealing process uniform and fully automatic.—*Brown, Boveri Mitteilungen*, October, 1929.

Electric Water Heaters.—E. STIEFEL.—The city of Basel (Switzerland) holds probably the world record for the number of electric water heaters connected to its system. With a population of 152,000, there are a total of 11,800 kw. heaters installed, consuming annually 21,800,000 kw.-hr. of hydro-electric energy. Since all of this power is confined to low rate night hours, the load curve of the city shows a practically filled night valley. The present paper explains the development and popularization of the heater load. The beginning of this remarkable condition goes back to the war years, when even neutral Switzerland had to suffer under a severe curtailment of gas and coal supply. To relieve this lack of fuel, the municipal service corporation offered a low power rate during the night hours, automatically cut in and out by reliable time switches, to store heat in well-insulated hot water tanks of sufficient contents to supply an average day's demand. The cost of heater, time switch and installation was defrayed by either low rental or buying on a six-

year installment plan. The heating hours were later extended also to the time from Saturday noon to Monday morning, which provided ample hot water for week-end bathing.—(*Bulletin de l'Association Suisse des Electricians*, October 22, 1929.

Traction

British Railway Electrification.—A. T. DOVER.—The main line of the Southern Railway (England) between London and Brighton, a distance of 51 miles, is to be electrified. This step marks an epoch in railway history in Great Britain, since the financing of the conversion is secured through a remission of the government's duty on passenger fares. It is said that other British railways will follow suit. This line is relatively short and fairly level with a high passenger density and offers an excellent route along which to initiate electric service. The requirements of high-speed trains and intensive service make the project an exceptionally interesting one. The drive will be by means of electric locomotive with individual axle drives and a gear-frame-mounted motor. It is estimated that outputs up to 1,000 hp. per axle are practicable.—*Electrical Review (England)*, November 1, 1929.

Express Locomotive.—In consideration of satisfactory results obtained on a trial locomotive, the French Paris-Lyon electric railway ordered four more engines of a similar type for its Mount Cenis line. It is claimed that these locomotives represent the most powerful units in the world, having actually 64.24 lb. of weight per horsepower. The machines are for operation on 1,500-volt direct current and have a one-hour rating of 5,400 hp. A maximum speed of 80.7 m.p.h. can be maintained with a tractive effort of 79,340 lb. The engine has six driven axles, each actuated by a double motor with 1:3.185 quill drive gear interposed. Among the many possible combinations of the twelve motors, the designers have chosen twelve most economic running speeds from series to parallel operation. Highest speed is reached with three armatures in series and four groups in parallel. The machines are 78 ft. long and weigh complete 156 tons, of which 106 tons are adhesive weight.—*Bulletin Oerlikon*, November, 1929.

Telegraphy, Telephony, Radio and Signals

New Type of Receiving Set for Extremely Short Waves.—SHINTARO UDA. The difficulty of designing a set for the satisfactory reception of ultra short waves (below 100 cm.) led the author to develop a new one. It is stated that when the signal intensity is fairly strong it is easy to detect modulated waves even with extremely short waves, but if very weak signals from a considerable distance are to be intercepted care must be taken to obtain satisfactory results. The essential factors are the arrangement of the circuit, particularly the tuning circuit; adjustments in tuning, such as sliding the conductor or the short circuit condenser, or else adjusting the filament current, grid voltage or anode voltage being unsatisfactory. These methods are accompanied by clicks or disturbing noises and are objectionable. The set devised by the author permits a closer adjustment in tuning than an ordinary condenser. Not only is the design of this set indicated but suggested methods of operation in order to secure satisfactory results have been given. Vol. VIII, No. 4, *Technology Reports of the Tôhoku Imperial University (Japan)*, 1929.

Practical Short Wave Limit of Triode Vacuum Tube Oscillators.—SHINTARO. UDA.—As the result of an investigation of short wave oscillators of the normal type in which the generation builds up oscillations in a resonant circuit it has been determined that the physical limits for ultra short waves for ordinary commercial use lie between 3.5 and 1.1 meters, the length depending upon the type of tube used. It is stated that the only prospect of further reduction in wave length seems to lie in the construction of special tubes. The reduction of the physical dimensions of the oscillation circuit makes it necessary to put the circuits inside the tube itself. The inter-electrode capacity of such a tube must be kept low. The author has investigated the various factors entering into the situation and has made several recommendations.—Vol. VIII, No. 4, *Technology Reports of the Tôhoku Imperial University (Japan)*, 1929.

Miscellaneous

New Slide Rule for Wire Tension of Poles.—C. HECKEL.—A slide rule is described by the author which enables quick calculation of the pull of a three-phase line exerted at the top of a pole. The stationary part of the rule holds two sliding tongues, with a total of eight scales, containing as variables the size of the (three) conductors, wind velocity, span, angle of pull, tension and resulting pull.—*Revue Générale de l'Electricité*, October 5, 1929.

Hardening of Superhardened Steel by Magnetism; the Lattice-Resonance Hypothesis.—E. G. HERBERT.—The increase of hardness which occurs in previously work-hardened metals when they are subjected to low-temperature annealing has been the subject of much research and has been made use of in the bluing of cold-drawn tubes to increase their strength. The author's invention, the cloudburst process, for producing a work-hardened surface on metals by bombardment with hard-steel balls, has led to an investigation of these phenomena with a view to their practical application in increasing the hardness of the work-hardened layer. It was found out that when metals so diverse as brass, low carbon steel, stainless steel, invar and high-carbon steel and high-speed steel had been work-hardened by the cloudburst bombardment they all possessed a propensity to become still harder. It was known that this propensity was to some extent satisfied by the process of aging and similar factors. As a substitute for low-temperature annealing magnetic material may be subjected to reversals of magnetic polarity affecting the structure of the material. Various experiments have been made to substantiate the lattice-resonance hypothesis and the results of considerable research are reported upon.—*Engineering (England)*, *November* 1, 1929.

Aërial Surveying in Canada—A general review of the progress of aërial surveying and of the results achieved through the use of this modern procedure. In this discussion the historical and experimental work has been reviewed. Particular attention has been devoted to forestry surveying, aërial photography for water-power purposes and the mapping of mineral areas. An indication of the economies and superior results obtained in water power survey work has been made.—*Engineer (England)*, October 18, 1929.

Book Reviews

New Levels in the Stock Market

By Charles A. Dice, professor of business organization, College of Commerce and Journalism, Ohio State University. New York: McGraw-Hill Book Company. 264 pages.

This is a rather remarkable covering of the new level of prices maintaining toward the end of the 1925-29 bull market. The critic would be inclined to say that Professor Dice spoke too hastily and might have reversed many of his opinions had the crash of October and November preceded the publication of his book. On the other hand, the writer specifically states his belief that major up or down swings have by no means ceased and his picture of the situation is accurate up to the end of the period he started out to cover.

Book Note

SIX PLACE TABLES. Third Edition. Explanatory notes by Edward S. Allen. New York: McGraw-Hill Book Company. 167 pages. Price, $1.50.

The chief improvements in this edition affect the tables of natural trigonometric functions. The values of secant and cosecant have been added. All functions are given correct to six decimal places, in order that as accurate computation may be made with these tables as with logarithms. Tables for conversion between radians and degrees are included for the first time, and such errors as have been noted in the preceding editions have been corrected.

News of the Industry

Seattle's Council Blocks Navy's Plan

Will Not Consent to Power Administrator as Condition of Federal Aid in Shortage—Tacoma Imposes Radical Restrictions—Company's Position

SEATTLE'S City Council on Wednesday refused to ratify the proposal made by Secretary of the Navy Adams that Governor Hartley appoint an administrator to allocate energy generated by the airplane carrier *Lexington* if put in use. Secretary Adams said he would send the *Lexington* to Tacoma provided an administrator were appointed. The Tacoma city officials and the Puget Sound Power & Light Company previously had agreed on the administrator plan, with reservations, but Mayor Frank Edwards of Seattle referred the whole matter to the City Council. Governor Hartley declares that the newspapers are magnifying the gravity of the situation.

While the matter of appointing an administrator is being thrashed out Tacoma's industrial power users have been advised that they will be expected to reduce power demands by 25 per cent as soon as possible. It is announced that with this reduction in demand, coupled with the economies enforced upon merchants and householders and in street lighting, Tacoma's plant can keep the city supplied for six weeks barring breakdown.

James D. Ross, the Seattle superintendent of lighting, says in a written statement to a correspondent of the ELECTRICAL WORLD: "Power conditions in Seattle are as follows: Daily production, 1,000,000 kw.-hr., 70 per cent steam, 30 per cent hydro. No consumers have been disconnected. Interchanging with Tacoma all surplus. Taking only 5 per cent output from storage, which will last for weeks. Private company has disconnected all water-rate contracts. Restriction of street lighting in Seattle voluntary to meet request of Secretary of Navy for betterment of Northwest conditions."

A. W. Leonard, president of the Puget Sound Power & Light Company, says: "Production of electrical energy by the water-power plants of my company is far below normal. However, the deficiency is being made up not only by the Shuffleton steam plant but by standby steam plants of the company located throughout its territory and reciprocal power contracts with other producers. The company has an ample supply of power to meet the needs of its customers and does not anticipate any curtailment of use of its service. However, the company has discontinued furnishing service to surplus water-power customers and has been able to transfer part of its industrial load from day to night shifts."

British Columbia Also Suffers from Prolonged Drought

Vancouver, B. C., like other cities on the Pacific Coast, has been affected by the lack of rainfall and the consequent power shortage. This district is served exclusively by the British Columbia Electric Railway Company with hydroelectric power plants at Lake Buntzen, Alouette Lake and Stave Falls.

Lake Coquitlam, which supplies the Lake Buntzen plants, has an average rainfall of 141 in., but in the first eleven months of this year there has been only 66.5 in. At the present time Lake Coquitlam is 67 ft. below high water level and Stave Lake 29 feet.

Anticipating a possible shortage, the company has been operating its steam plant almost continuously since January last. On November 18 it took active steps to reduce its load. The city of Vancouver immediately curtailed its street lighting after 8 p. m. and suspended the operation of a sign-lighting bylaw which required electric signs over public property to be lighted. The power company also took steps to reduce its street-car service, substituting buses.

Supplementary power sources are being organized, including lumber mills which burn hog fuel. Enough generators are expected to be tied in shortly to provide about 200,000 kw.-hr. daily. No industries have been cut off from power supply, but many have voluntarily reduced their load.

With the water in the lakes dropping about 500,000 kw.-hr. a day, the company believes it has sufficient power for 20 to 25 days, by which time some relief in the form of rain is expected.

Mississippi at Low Level

Despite the fact that the level of the Upper Mississippi River is at an abnormally low stage, plants of the Northern States Power Company will continue to operate at full capacity, Meyer Barnert, general superintendent of the company, reports. The plants are equipped for steam operation in the event of water-power shortage, he points out, and a switch will be made whenever necessary.

According to government records, the river has fallen to a mark of minus 24, the lowest in history with the exception of one short period in February, when it fell to minus 27. The November levels in the past five years have ranged from the present low mark to plus 14.

No Power Curtailment in Oregon

But the Existing Situation in That State Is One Without Precedent—Steam Plants and Interconnection Save the Day

THERE is no power shortage in Oregon, the ELECTRICAL WORLD's Portland representative wires, but the worst fall drought since 1890 has served to emphasize the importance of steam auxiliaries and of interconnection. This is best illustrated in the Portland area, where normally at this time of year only about 35 per cent of the load is carried by steam plants, whereas at the present time steam is taking care of about 64 per cent.

The addition on schedule in September of a new 25,000-kva. steam unit by the Northwestern Electric Company and the existence long prior to the present situation of a contract for exchange of energy between the two companies have been factors in relieving what otherwise might have been a serious situation. The steam facilities of the Mountain States Power Company to the south have also been called upon.

The Portland Electric Power Company reports during November and early December the generation of 55 per cent of its requirements by steam as compared with 20 to 22 per cent at this time last year, which was representative of operations in a year of normal water conditions. The Northwestern Electric Company is supplying 83 per cent of its load from its steam plants against about 62 per cent at this season of a normal year.

In all other districts in the state the unprecedented situation is being adequately met either through increased use of steam plants or a more extensive reliance on purchased power from companies having excess capacities. At no point in the state have resources approached exhaustion.

Thirty-two Business Groups Confer at Washington

Representatives of 32 manufacturing and distributing groups met in Washington at the headquarters of the Chamber of Commerce on Thursday morning of this week to consider, at the request of President Hoover, measures looking to the maintenance of business activities at the high levels to which they have attained. Distinguished leaders in producing, trading and transporting enterprises and government representatives reviewed existing con-

ditions and prospects and appraised the possibilities for wider co-operation on the side of business itself and between business and government in advancing the national economic welfare and preventing any recession in business enterprise.

Approximately two hundred business men occupying key positions in trade organizations were invited to represent their various lines of activity. In addition to these, a number of individual business men of recognized authority in the field of practical economics attended. Among the 32 groups represented were two listed as "electrical" and "utility." Men especially well known in the electrical field who were to participate included M. S. Sloan, who was the representative of the light and power industry; General James G. Harbord, Edward N. Hurley, Charles Piez, Clarence L. Collens, Philip H. Gadsden, Gerard Swope and Malcolm Muir of the McGraw-Hill Publishing Company.

Gloucester Buries Municipal Plant Proposal

Voters of Gloucester, Mass., on Tuesday defeated overwhelmingly a proposal to establish municipal ownership there through the purchase of the Gloucester Electric Company's plant. The vote stood 6,145 to 312—one of the most smashing defeats in urban history. Had the scheme gone through, the tax rate would, it was estimated, have leaped upward by $50 per thousand.

The Gloucester company is controlled and managed by Charles H. Tenney & Company, Boston. (See ELECTRICAL WORLD, November 30, page 1098.)

Elkins, W. Va., Fails to Vote Municipal Plant

At a special municipal election held in Elkins, W. Va., on November 26 to submit for the second time the question of the issuance of bonds to the amount of $135,000 for construction and installation of a municipal electric light and power plant, the voters failed to ratify the issue. Although its proponents had a majority of 304, that was 38 votes less than the necessary three-fifths. Exactly 1,900 votes were cast, there being 1,102 for ratification and 798 votes against, 1,140 being necessary to ratify the issue. When first submitted at the general municipal election held on March 5, the bond issue was approved by the voters, but the Attorney-General's office at Charleston held the issue to be invalid, owing to the provisions made for the payment of maturing bonds.

Before the question was submitted the first time the Monongahela-West Penn Public Service Company announced a reduction in rates which became effective early in the spring, and that appears to have been a factor last week in leading many to vote against the installation of a municipal plant.

Public Utilities as Factor in Prosperity

THAT the public utilities have grown to the point where they are a more important factor in general prosperity than are the steam railroads was indicated at the conference of utility leaders with President Hoover held on November 27 and referred to in the ELECTRICAL WORLD for last week (page 1092), when the names of the delegates were printed.

One of the striking features of the conference was that no man who spoke used the word "if." The program for the expenditure in new construction of a sum approximating a billion and a half has been definitely decided upon and will be carried out.

The attention of the President was called to the fact that the volume of consumption of electric power is a good index of business conditions. The small falling off of use in the automobile and rubber industries has been more than offset by the general rate of growth.

After the conferees, who represented companies having central offices in nine states and the District of Columbia and whose interests touch the major portion of the country, had left the White House, many of them gave out in detail the amounts their companies plan to expend in new construction and maintenance in 1930. Some of these detailed estimates are printed under "Financial and Statistical" (page 1150).

Couzens May Drop Power Regulation from Bill

Hearings on the Couzens bill providing for the creation of a Federal Communications and Power Commission to regulate radio and interstate telephone and telegraph operations, together with the interstate operations of electric power companies that transmit power across state lines, were begun before the Senate interstate commerce committee in Washington on December 4. The radio aspects of the bill being taken up first.

Senator Couzens has stated informally that he is now of opinion that the feature covering the regulation of power should be omitted from this bill. He has become convinced that it would be better that this be embodied in a bill enlarging the powers and operations of the Federal Power Commission.

President's Recommendations on Energy

Mr. Hoover Asks that Federal Power Commission Be Remade and Have Degree of Jurisdiction Over Interstate Transmission—Would Dedicate Muscle Shoals to Agricultural Chemistry

TWO or three recommendations in President Hoover's annual message to Congress, transmitted last Tuesday, stand out as of especial interest to the electrical industry. One of these is that full-time members be appointed to the Federal Power Commission to take the place of the Secretaries of War, Agriculture and the Interior, who now make up the board. In addition, Mr. Hoover would vest in the Power Commission a certain degree of jurisdiction over interstate transmission. Joint action by the states concerned would by his plan be made effective by the federal board, and in case of disagreement or non-action by the states that board would act independently.

Reiterating his well-known antipathy to putting the federal government into business, the President expresses the view that the Muscle Shoals plants should be operated for the benefit of agriculture and asks Congress to set up a commission with authority to negotiate suitable contracts on behalf of the government with this end in view. Boulder Dam contracts, he said, must insure the return of all government outlays upon that project.

The President's remarks upon these topics follow:

Electric Power Regulation.—The Federal Power Commission is now composed of three Cabinet officers, and the duties involved in the competent conduct of the growing responsibilities of this commission far exceed the time and attention which these officials can properly afford from other important duties. I recommend that authority be given for the appointment of full-time commissioners to replace them.

It is also desirable that the authority of the commission should be extended to certain phases of power regulation. The nature of the electric utilities industry is such that about 90 per cent of all power generation and distribution is intrastate in character, and most of the states have developed their own regulatory systems as to certificates of convenience, rates and profits of such utilities. To encroach upon their authorities and responsibilities would be an encroachment upon the rights of the states. There are cases, however, of interstate character beyond the jurisdiction of the states. To meet these cases it would be most desirable if a method could be worked out by which initial action may be taken between the commissions of the states, whose joint action should be made effective by the Federal Power Commission, with a reserve to act on its own motion in case of disagreement or non-action by the states.

Muscle Shoals.—It is most desirable that this question should be disposed of. Under present conditions the income from these plants is less than could otherwise be secured for its use, and more especially the public is not securing the full benefits which could be obtained from them.

It is my belief that such parts of these plants as would be useful and the revenues from the remainder should be dedicated for all time to the farmers of the United States for investigation and experimentation on a commercial scale in agricultural

chemistry. By such means advancing discoveries of science can be systematically applied to agricultural need, and development of the chemical industry of the Tennessee Valley can be assured.

I do not favor the operation by the government of either power or manufacturing business except as an unavoidable byproduct of some other major public purpose.

Any form of settlement of this question will imply entering upon a contract or contracts for the lease of the plants, either as a whole or in parts, and the reservation of facilities, products or income for agricultural purposes. The extremely technical and involved nature of such contracts dealing with chemical and electrical enterprises, added to the unusual difficulties surrounding these special plants, and the rapid commercial changes now in progress in power and synthetic nitrogen manufacture, lead me to suggest that Congress create a special commission, not to investigate and report as in the past, but with authority to negotiate and complete some sort of contract or contracts on behalf of the government, subject, of course, to such general requirements as Congress may stipulate.

Boulder Dam.—The Secretary of the Interior is making satisfactory progress in negotiation of the very complex contracts required for the sale of the power to be generated at this project. These contracts must assure the return of all government outlays upon the project. I recommend that the necessary funds be appropriated for the initiation of this work as soon as the contracts are in the hands of Congress.

Wilbur on Government's Office in Realm of Hydro Power

In his annual report to the President, Ray L. Wilbur, Secretary of the Interior, makes the following remarks on hydro-electric power as it is affected by the activities of the Interior Department:

This department encounters hydro-electric power problems in two capacities—first, in its administration of reclamation projects and Boulder Dam; second, by reason of the Secretary's position on the Federal Power Commission. As to the latter class, the activities of the department will be directed toward hearty co-operation with the Power Commission. As to the former class, a policy will be followed which will insulate the United States as completely as may be from interference with local interests and regulation. It is my belief that the proper office of the United States ends with the construction of dams and incidental structures for primarily federal purposes only, such as navigation control, flood relief, reclamation, etc., leaving it to municipal or private initiative to develop and market the power under lease of rights to the falling water.

That policy is being followed in working out the many problems attendant on Boulder Dam. Under the direction of the Commissioner of Reclamation, Dr. Mead, engineering plans are progressing in a satisfactory manner, with the assistance of an augmented field force. An advisory group of experts on electrical engineering and plant management is functioning and has collaborated with the bureau in determining the financial basis on which the power shall be marketed. Work on the dam will be begun as soon as adequate contracts have been negotiated and congressional appropriations made.

Great Lakes A.I.E.E. Meets in Chicago

Well-Attended Meeting of Fifth District Learns of New Developments in Auto-Valve Lightning Arresters, Fault Bus Installations, Superspeed Excitation and Other Lines of Practice

AN IMPORTANT advance in lightning-arrester design was described to the American Institute of Electrical Engineers at the Great Lakes, or Fifth District, meeting in Chicago on December 2 to 4. Other papers dealing with matters already in development, such as fault buses, high-speed excitation and underground networks, were of particular merit. Because some of the subjects were controversial, the discussions were spirited. The convention drew an attendance of about eight hundred, including two hundred students from the six states—Illinois, Indiana, Iowa, Michigan, Minnesota and Wisconsin.

Of exceptional interest was the large part taken by student activities. At the students' technical session thirteen papers were presented, all of which showed a keen appreciation among the students of contemporary problems in electrical engineering and that they were already capable of analyzing and suggesting solutions.

The session on power plants included five very interesting papers. I. E. Moultrop discussed the future of higher steam pressure and stated that the overall economy of the larger-size units is equal to present good practice. The fault ground bus was highly commended by a number of speakers after the presentation of a paper, describing the use and design of that equipment at the Brunot Island station of the Duquesne Light Company, by R. M. Stanley and F. B. Hornibrook. It was pointed out that this device eliminates the necessity of a large number of current transformers, makes unnecessary the careful balancing of relays required for differential protection and permits use of instantaneous relays to clear faults inside the station.

Some opinions differing from the conclusions reached by C. M. Laffoon in his paper on increased voltage for synchronous machines were advanced in the discussion which followed. These opinions related to the characteristics of insulating material and design of winding. It was remarked that even with high voltages it may still be necessary to use transformers to prevent surges from entering the generator. P. L. Alger, E. A. Freiburghouse and D. D. Chase definitely preached the greater desirability of the split-felt type of winding as against the alternate-slot type in double-winding generators, but this opinion was challenged in the discussion. Despite differences in preferences, it was apparent that the type of winding to use depends largely on the system and that the requirements for waterwheel and for steam-turbine units would be quite dissimilar. The discussion centered largely on the allowable degree of unbalance between the two windings on any one machine, and in this connection Mr. Chase called attention to experience with the New York Edison Company's double-winding generator in which 80,000 kw. had been carried on one winding while the other was carrying no load. The session was closed by an interesting paper by E. S. Bundy, A. Van Niekirk and W. H. Rodgers, describing a 40,000-kw. variable-ratio frequency-converter installation which connects the 25-cycle and 60-cycle systems of the Niagara, Lockport & Ontario Power Company. The two machines in this installation are capable of a frequency-ratio variation of from 98 to 101 per cent of a nominal 25-to-60 ratio.

A new valve-type lightning arrester was described in a paper by J. Slepian, R. Tanberg and C. E. Krause. The electrical discharge occurs through the minute holes in naturally porous materials, the effect being to raise the cut-off voltage appreciably. To reduce the breakdown voltage to desired values experiments were made on porous material to which had been added finely divided conducting material. K. B. McEachron of the General Electric Company pointed out in the discussion that his company had developed an aluminum-zircon disk arrester with a 500-volt breakdown and a 300-volt cut-off peculiarly suitable for secondary work. E. F. W. Beck of the Westinghouse company stated that the arrester described had already undergone 2,500 arrester years' service with satisfactory operation, a comment which added considerably to the promise made by the authors of the paper that they would soon have a more definite communication to make on actual design.

Preference expressed by Philip Sporn in his paper for single-frequency carrier communication stimulated argument by proponents of other systems. R. J. Wensley, Westinghouse company, contended that the author of the paper failed to give consideration to the very satisfactory experience of the Alabama Power Company and the Indiana Electric Service Company. E. W. Burbank, Buffalo, Niagara & Eastern Corporation, also reported very satisfactory experience with carrier current. He questioned whether it would be possible to get as good speech transmission with two-frequency as with single-frequency carriers because of the necessary width of carrier bands.

The report on low-voltage alternating-current networks by R. M. Stanley and C. T. Sinclair elicited considerable discussion on the primary value of such networks, their intensive use, the relative value of single-phase and three-phase network transformers and the size of cable which will burn free.

D. K. Blake, General Electric Company, pointed out that the culmination of literature on the subject shows the

reliability of alternating-current networks and that they are chiefly valuable for handling fast-growing loads, whether they be in highly concentrated districts like New York or the more sparsely settled sections of New Jersey where they are now being installed. Henry Richter, Westinghouse company, asserted that alternating-current networks are in use or are being installed on 47 properties and in four foreign countries in communities ranging from the size of New York to places of 4,000 population.

The popular subject of stability was not neglected at this meeting. It was represented by an excellent paper by C. A. Nickle and C. A. Pierce on the effect of armature resistance on stability of synchronous machines. A labor-saving method for tabulating the performance of polyphase induction motors from previously determined constants was presented by W. J. Branson, and G. R. Anderson described a torque indicator that records the torsional effect of motors during acceleration. The existence of ionization currents of high magnitude previous to the final breakdown of installation was established in a paper by J. J. Torok and F. D. Fielder. There were a number of other very good papers.

Purchases and Mergers

Control of the Stevens County Power & Light Company and its holding company, the Stevens County Public Service Company, serving Stevens County, in northeastern Washington, has been purchased by the American Power & Light Company through the Kootenay Power & Light Company of Coeur d'Alene, Idaho, according to the announcement of Miles W. Birkett, vice-president and general manager of the Washington Water Power Company, which is also controlled by the American Power & Light Company. It is understood that about $1,000,000 has been paid for the properties.

Approval has been granted by the Connecticut Public Utilities Commission to the plan of the Connecticut Power Company to acquire the Stamford Gas & Electric Company.

Lake Mills, Iowa, now served by the Interstate Power Company, will vote on December 18 upon a proposal to establish a municipal plant. The Interstate's franchise does not expire until 1937.

The Iowa-Nebraska Light & Power Company has submitted a proposal to the City Commissioner of Beatrice, Neb., to purchase the municipal lighting plant for $150,000 and thereafter to supply energy for street lighting and water pumping at 1¾ cents per kilowatt-hour.

The Earl W. Baker Utilities Company of Oklahoma City will about December 10 take over the municipal power and water system at Canton, Okla. The sale was approved by the voters several weeks ago.

Martin J. Insull of Chicago and Ford, Bacon & Davis, Inc., have entered into a contract, press reports say, under which the former is purchasing not less than 90,000 shares of the common stock of the Pecos Valley Power & Light Company of Fort Worth, Tex., of which there were 110,020 shares outstanding. Mr. Insull will take over the remainder at the same price, $5.50 each.

The offer of the British Columbia Electric Railway Company to buy for $600,000 the Kamloops (B. C.) 2,000-hp. municipal hydro-electric plant and a steam plant of 1,500-hp. capacity was ratified by the voters on November 20. The purchase takes effect on January 1.

Ownership of the properties of the Maritime Coal, Railway & Power Company in Nova Scotia and New Brunswick has been obtained by the Utilities Power & Light Corporation. The Maritime company supplies electric power to Springhill, N. S., and Amherst and Sackville, N. B.

Federal Power Commission's Accounting

Baltimore Newspaper Publishing Series of Articles Designed to Show Importance of Pre-License Cost Figures—Overcapitalization Charged

CONTENTION over the accounting activities of the Federal Power Commission, which because of the inadequacy of its own accounting force is far behind with the work of auditing power-company capitalizations, has led the Baltimore *Sun* to begin the publication of a series of articles by a member of its Washington staff to illustrate the importance of the commission's accounting work and to show the extent to which, as this writer puts it, certain power companies have been declared to be overcapitalized.

In the first of these articles, printed on November 30, the pre-license costs of the Conowingo project are taken up, the article saying:

"Out of a total pre-license cost of $7,246,832.07 claimed for the Conowingo project by the various companies sponsoring it, the sum of $3,443,708.35 'appeared not to be a proper charge,' according to the joint auditing committee appointed by the Federal Power Commission and the public utility commissions of Pennsylvania and Maryland to examine the accounts. In addition to this sum, the committee found that $712,870.58 was of 'doubtful' expenditure and should be 'included in the project costs only if supported by affirmative evidence.' Despite these findings, which were reported as long ago as November 1, 1926, the pre-license cost of the Conowingo project never has been established."

The second article cites the application of the Clarion River Power Company of Pennsylvania, controlled by the Associated Gas & Electric Company, and says:

"More than $6,000,000 of alleged cost is represented merely by entries on the books and is unsupported by evidence of expenditures or cost, the commission's accountants report. Although the company alleges that its total claim of $11,032,816.57 capital expense is legitimate, it refuses to allow the commission's accountants access to its records. Because of this the case has never been settled and the accountants report that 'further action is dependent upon securing means to prosecute such cases of apparently flagrant lack of compliance with the law.'"

Departmental Help Sought for Power Board Accounting

For years the Federal Power Commission has asked Congress for an increase in its accounting staff, and last year it received a small additional appropriation for the purpose. A plan has been evolved by F. E. Bonner, executive secretary of the commission, whereby the three departments would assign men to do field work for the commission. This plan met with some degree of opposition from William V. King, the chief accountant. Senator Nye's agitation over the matter was reported last week (page 1093).

The minutes of the meeting of the commission held on November 27 record that the chairman raised a question as to the progress being made on clearing up the overdue accounting work on licensed projects and license applications. The executive secretary reported that although the personnel for such work had been considerably increased since July 1 and instructions issued in regard to restricting the accounting activities to essential work, the progress made had been disappointing. He recommended, therefore, that the accounting work be placed on the same basis as all the rest of the commission's activities and the cases referred as far as practicable to the proper field agencies of the three departments for investigation and report.

The chief accountant and the solicitor expressed doubt relative to the possibility of having the field examinations performed by the departments because of the fact that numerous claims contain some items of questionable character which must be investigated by accountants skilled in ferreting out improper practices. It was, however, directed that every effort be made to enlist the aid of the proper agencies of the three departments in clearing up, under appropriate instructions by the chief accountant, the accumulation of account work.

Action on Distribution System Sought in San Francisco

A recommendation that a proposal be submitted to the people of San Francisco next spring for a bond issue of $55,000,000 to acquire the distribution systems of the Great Western Power Company and the Pacific Gas & Electric Company will be made to the Board of Supervisors in the near future by City Attorney John J. O'Toole. Mr. O'Toole is said to base his proposal on his personal belief that the Pacific Gas & Electric Company has decided to drop its appeal to the California Supreme Court against the Railroad Commission's valuation of its distribution lines.

The Other Side of Submetering

Landlords and Officials of Companies Pursuing This Business Give Their Views to Commission Investigating New York State's Laws for Utility Regulation

SUBMETERING, which was the subject of lively hearings before the New York Public Service Commission beginning just a year ago and continuing through the early months for 1929, was introduced last week into the proceedings of the New York legislative commission appointed to inquire into the Public Service Commission laws. The hearings before the regulatory body, which were postponed last April owing to the engagements and illness of counsel and have not yet been resumed, were occasioned by protests against the attempt of the New York Edison Company to abolish the practice. They were reported in the ELECTRICAL WORLD at the time they were held.

The investigating commission, in reviewing the essential elements of the subject, called a succession of witnesses in favor of submetering. These men were virtually unanimous in predicting that building owners, in the event of the abolishing of submetering, would reestablish wherever possible isolated plants shut down or removed upon the representations of the New York Edison Company, under a former management, that they would do better to purchase wholesale power with the submetering privilege. The witnesses maintained that the profit which the landlord accepted was his just due, dwelt upon the alleged low cost of private-plant operation, accused the utility of bad faith in seeking to destroy the arrangement under which private plants had been removed from old structures and omitted entirely from new ones, admitted need for regulation of submetering in so far as accuracy and testing of meters, customers' deposits and maximum rates for submetered energy are concerned, and declared their belief that the utility company could not reduce rates should submetering be abolished.

Peter Grimm, president Real Estate Board of New York, testified that the general practice in submetering is to bill tenants at the same rate as that for retail energy supplied by the New York Edison Company, there being, he said, only two known instances of higher charges and "innumerable" cases of lower charges and free electricity. He asserted that 7,500 buildings in Manhattan are now submetered; that the losses in revenue to owners of two large office buildings were submetering abolished would be $31,000 and $23,000 respectively; that in a certain new structure space has been provided for a private plant, for use should submetering cease, at a cost of $250,000; that the saving of $12,000,000 promised consumers if submetering be abolished would prove imaginary, and that without submetering one large office building would have a reduced annual income of $31,330—this representing at 6 per cent a capitalized loss of $522,000.

J. C. Cushman, president Building Managers and Owners' Association, stated that in the absence of submeters bond issues on large buildings would shrink in value, that the new Chrysler Building would have 17 per cent higher operating expenses and that he is "as certain of the resumption of private plant operation as of anything in his life" if submetering goes.

Clarence Coley, operating manager Equitable Building, testified as a representative of a large building with full private-plant service, pointing out that electricity generated as a by-product of building steam requirements, whether steam be generated or purchased, reduces the cost of generating power. The witness offered an actual operating cost (excluding depreciation, taxes or interest) of 1.87 cents per kilowatt-hour for his building if building steam requirements be disregarded and 0.99 cent if they be taken into account. The New York Edison cost would have been 2.4 cents, he maintained.

"If submetering be withdrawn," said H. L. Glynn, engineer for the Chanin Construction Company, "the owners of the Chanin Building will lose $48,000 profit from energy sales and will install their own plant not only to supply their own and tenants' needs but for two neighboring structures as well."

Lee Smith, secretary Pease & Elliman, offered evidence showing that submetering is in vogue at regular utility retail rates in Omaha, Seattle, Atlanta, Louisville, Houston, Detroit and Cleveland; at regular rates or less in St. Louis, Dayton, Pittsburgh and Spokane; at equal or higher rates in Kansas City and Chicago, and is free in San Francisco, Denver, Salt Lake City and Boston. Submetering is regulated in Omaha, Cincinnati, Dayton, Cleveland and Montreal.

The resale or submetering privilege was always held out by solicitors for the New York Edison Company as a definite advantage for the building owner who abolished the private plant, said Ralph Dudley, formerly an assistant general agent for the New York Edison Company, in telling of his ten years in such work with that utility. Mr. Dudley estimated $15,000,000 to $20,000,000 as the amount made in New York City each year through resale of energy, but landlords, and not submetering companies, get the big profits.

Mention by Mr. Dudley of the installation of electric signs by the New York Edison Company advertising the utility and the owner of a building with no charge for either sign or energy brought protests from Professor Bonbright of the investigating commission, who viewed this practice as a rebate and consequently discriminatory and comparable to railroad practices long since judged illegal.

A former consulting engineer for the New York Edison Company, R. P. Bolton, now president of the Electric Meter Corporation and engaged in submetering in 1,100 buildings in Manhattan and the Bronx, had only praise for submetering practices and ethics, seeing no need for regulation and citing satisfactory relations with customers. Combination heat, light and power genera-

Federal Power Board Visits Cumberland Falls

AN INNOVATION in the methods of the Federal Power Commission took place not long ago when the three Cabinet members who compose it inspected personally the site at Cumberland Falls, Ky., where the Insull utility interests wish to build a hydro-electric plant but which scenery preservationists and others declare should be left as it is to form a public resort. Left to right in the picture are Secretary Hyde, the late Secretary Good and Secretary Wilbur.

tion was viewed as having a cost for the building owner far below that at which a utility could provide electricity. Mr. Bolton has been responsible for much low-pressure-steam by-product electricity in New York. "It would be better for the utility companies if they had never had to distribute energy to the retail customer at all," said Mr. Bolton in response to an inquiry regarding the desirability of extending submetering practices. "Too many small customers with low revenue per month make this business unattractive."

A number of others testified.

Canada's Hydro Projects

Carillon Falls Site Under Discussion Again — Beauharnois May Export Power to Ontario but Not United States—Powell River Enterprise

POWER development at Carillon, on the Ottawa River, is to be revived as a subject for discussion at the forthcoming conferences between representatives of the Dominion, Ontario and Quebec governments. When this project was up for consideration a few years ago, it developed into a political controversy. It then had reference to the Georgian Bay Canal scheme, the charter for which had been obtained by the Sifton interests. Renewal of the expiring rights was sought, but in the face of opposition and obstruction this was withdrawn. The Carillon Falls site is one in which Ontario and Quebec have a joint interest because, while the site proper backs up into Ontario, it is right on the boundary.

Large developments are known to enter into the calculations of the next few years. The Beauharnois project is already under way, and it is safe conjecture that in time the company behind it will seek to enlarge greatly the proposed development of 500,000 hp. by utilizing a greater flow of water. If Carillon is also to go on the market, the developments from the two rivers—St. Lawrence and Ottawa—will, it is believed, fully keep pace with and even anticipate industrial progress. If the agreement which is looked for at the forthcoming conference is not frustrated by things now unforeseen, past sources of trouble will be extinguished and the way paved for some huge power developments.

Premier Taschereau of Quebec is responsible for the statement that his government has made an amicable arrangement whereby the Beauharnois Power Corporation may sell to the Province of Ontario electrical energy up to half of its output under definite guarantee that none of the power purchased be exported to the United States. The other half of the power generated will be retained in Quebec for the development of industries there. Successful negotiations between the company and the Ontario authorities are reported below. Premier Taschereau has definitely stated that the Quebec government will not impose any export tax or demand any royalty on Quebec power exported to Ontario.

The first contract given by the Powell River Company toward the eventual construction of its six-million-dollar additional hydro-electric projects on the Lois River, in British Columbia, has been awarded to Stuart Cameron & Company, of Vancouver. The power site is 12 miles from Powell River, location of the company's newsprint plant. The Cameron company will clear a right-of-way 150 ft. wide from Powell River to the site of the power house and will erect a transmission line. The right-of-way will be wide enough for two power lines, though only one is to be erected at present. The awarding of other contracts for the project, including those for the construction of the dam across the Lois River and a mile-long tunnel from the dam to the power house, will follow before the end of the year.

Can Electrical Manufacturers Hamper War?

A plan for the abolition of war by agreements among the great industrial leaders of the world to withhold from belligerent nations essential industrial raw materials has been presented by Edward N. Hurley of Chicago, war-time chairman of the Shipping Board, to M. Georges Theunis of Belgium, president of the International Chamber of Commerce, with a request that it be studied and elaborated by the chamber and placed upon the agenda of its next international meeting. Mr. Hurley's elaboration of his unusual proposal contains one portion of especial interest to the American electrical industry. In this he says:

> The great research laboratories of the major electrical and automotive industries produce knowledge and processes which are continuously improving technology. Any nation deprived of free access to the methods and machinery which are the fruits of their research would be absolutely handicapped.
>
> Such men as Owen D. Young, chairman of the board of the General Electric Company (already one of the most conspicuous leaders in the movement for world order and security); Gerard Swope, president of the General Electric Company; Charles F. Kettering, vice-president General Motors Research Corporation, and A. W. Robinson, chairman of the board of the Westinghouse Electric & Manufacturing Company, could bring about not only sentiment but constructive action toward mobilization of electrical enterprise for the abatement of war.

Ontario to Buy 250,000 Hp. from Beauharnois Plant

It has now been definitely announced that the Ontario Hydro-Electric Power Commission will buy 250,000 hp. of electrical energy from the Beauharnois Light, Heat & Power Company of Montreal, at $15 per horsepower. Under the contract terms, according to Premier Ferguson, the first of the power will be delivered in 1932 and the remainder spread over the ensuing four years. Up to 250,000 hp. the commission will get half of whatever power the Beauharnois company develops during this period from its undertaking on the St. Lawrence River, between Lakes St. Joseph and St. Louis, about 20 miles from Montreal. The signing of the contract will mark the close of the second big low-price deal negotiated by the commission. The other is the Gatineau contract by which the commission buys 260,000 hp., developed on the Gatineau River, at the same figure of $15 per horsepower.

Delivery of the Beauharnois power will be made at the interprovincial boundary. The details of construction are not yet fully worked out, but it is believed that the commission will erect a transmission line from the boundary to the present Gatineau line, a distance of 40 miles. The commission has authority to duplicate the Gatineau line, which runs into Leaside, outside Toronto, and it is thought that the Beauharnois power will be routed over this additional line.

Ninety Men Lunch in New York Edison's Boiler

Seated on a wooden platform, 43 ft. 6 in. long and 23 ft. 6 in. wide, built inside the newest of three huge boilers recently installed in the East River generating station of the New York Edison Company, high officials of that company, including its president and vice-presidents, dined on Monday of this week with foremen and other representatives of the skilled labor which brought about the completion on schedule time of the new 160,000-kw. generator in that station and the complementary equipment, at a total cost of $12,500,000.

The "dining room," raised 10 ft. above the bottom of the boiler and with a ceiling 85 ft. above the diners, was floodlighted, throwing into relief its more than 3,700 tubes, eleven steam drums, pulverized-coal burners and other contents. The three boilers, said by the company to be the largest in the world, were manufactured by the Combustion Engineering Corporation. President Sloan spoke, saying:

> "When the engineers of our companies laid out this six months' program, we were told it couldn't be carried out. We were told no such job had ever been done, and certainly this one could not be done in so short a time. Well, it *was* done. The first boiler was scheduled to be fired on October 15. It was fired on that date. The second boiler was scheduled to be fired on November 7. It was fired on that date. The third one was scheduled to be fired on December 1. It was built and ready on that date, but we held over the firing so we could have this celebration."

After the luncheon the platform was burned where it stood to season the boiler.

Briefer News

SNOWDEN (VA.) HYDRO PLANT READY.—Virtual completion of a 12,000-hp. hydro plant at Snowden, Va., on the James River, is reported. This plant, the cost of which is put at $1,600,000, was built by the Marcuse interests, which manufacture pulp and paper.

TO PROMOTE DEVELOPMENT OF COLUMBIA RIVER.— As a preliminary step in its program of fostering the material development of the Columbia River and its tributaries, the Columbia Valley Association has raised funds and commenced a survey of the navigation and power facilities of the river. Dr. Clark Black of Portland, Ore., is president.

REMOVAL OF CONNECTICUT PUBLIC UTILITIES COMMISSION ASKED.—A petition recently filed with the Attorney-General of Connecticut and duly signed by more than a hundred electors of that state asks the removal of the three members of the Public Utilities Commission on charges of remissness, the specific allegations concerning the removal of grade railroad crossings.

GEORGIA ASSOCIATION ASKS TWENTY DAYS' NOTICE OF RATE HEARINGS.—The Municipal Utilities Rate Association of Georgia has adopted a resolution asking the Georgia Public Service Commission to revise its procedure in connection with rate hearings so that cities shall have at least twenty days before the formal hearing in which to study the answers given by utility corporations.

CHEYENNE TO ENJOY PROMOTIONAL RATES.—Load-building rates have been inaugurated by the Cheyenne (Wyo.) Light, Fuel & Power Company by which both domestic and commercial customers will be benefited. The former domestic schedule was 11 cents a kilowatt-hour for the first 50 kw.-hr. and 10 cents thereafter. The new rate calls for a fixed charge of $1 a month for a six-room house, with 15 cents added for each additional room, but the rate for energy is only 5 cents for the first 50 kw.-hr. and 3 cents thereafter.

PROGRESS ON SEVEN SISTERS FALLS PLANT.—The important power development in Manitoba at Seven Sisters Falls, on the Winnipeg River, is now well under way. The Northwestern Power Company has nearly 800 men at work in the construction of what will be, when completed, the largest power plant in the Canadian West. Main coffer dams and subsidiary dams were completed some time ago. Excavation for the power house is more than half finished, and the working force will be kept busy all winter. The first three units of the plant will, it is planned, be placed in operation in the summer of 1931. These will develop 112,500 hp., and full installation will consist of six units with a gross development of 225,000 hp. The ultimate development will cost in the neighborhood of $23,000,000.

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY'S COMING SPRINGFIELD BUILDING.—As previously announced, the Central Illinois Public Service Company is to erect at Springfield, Ill., a fifteen-story office building, which will be the tallest building in the city. It will have a frontage of 145 ft. on Adams Street and a depth of 88 ft. on Sixth Street and will be built of Bedford stone, costing between $1,000,000 and $1,500,000. The floodlighting arrangements will be comparable, on a smaller scale, with the most elaborate installations in Chicago. An aërial beacon on

the tower will point to the commercial airport southwest of the city. In addition, the company is putting the finishing touches on a new warehouse at Ninth and Madison Streets, where its business offices are now housed, and has begun the work of adding three stories to its produce storage rooms at Tenth and Edwards Streets.

THREE-STATE LOOP FOR UNION LIGHT & POWER.—Completion of the new 75,000-kw. unit in the Cahokia plant of the Union Electric Light & Power Company of St. Louis brings the capacity of the Missouri-Illinois-Iowa system controlled by the North American Company to 572,000 kw. Transmission lines will be finished about January 1 for the delivery of service to the St. Joseph Lead Company, which will purchase 150,000,000 kw.-hr. of electricity annually for its plants at Rivermines, Mo. Transmission lines under construction will, together with existing lines, form a complete loop connecting the Cahokia, Ashley Street, St. Louis, and Venice, (Ill.) steam plants with the Keokuk (Iowa) hydro plant and the new hydro plant now under construction at Bagnell, Mo., on the Osage River.

PARIS, TEX., DALLIES WITH MUNICIPAL PLANT IDEA. — Under authority granted by a referendum of the citizens of Paris, Tex., the City Council has under consideration a proposal made by Fairbanks, Morse & Company for the construction of an electric light and power plant to cost not more than $450,000. The plant would be paid for out of net revenues derived from its operation.

KANSAS CITY POWER & LIGHT'S NEW UNIT.—A new 35,000-kw. turbo-generator went into service at the Grand Avenue generating station of the Kansas City Power & Light Company last week, bringing the total rating of that station up to 85,000 kw. and the maximum production of the five units there and in the Northeast station to 225,000 kw. The installation of the new machine completes a program entered upon ten years ago which has involved the expenditure of $56,000,000.

PUBLIC OWNERSHIP LEAGUE MEETS AT MUSCLE SHOALS.—Governmental operation of the Muscle Shoals plants and sale of surplus power direct to municipalities in contiguous territory were urged in resolutions passed by the Public Ownership League of America at the end of a recent four-day session at Muscle Shoals. Sale of the hydro-electric and nitrate plants to private corporations was opposed. A resolution dealing with Boulder Dam protested against allocation of power generated there to any corporation operating for profits.

PACIFIC GAS & ELECTRIC FIGHTS REDUCTION OF RATES.—The Pacific Gas & Electric Company, at a hearing last week before the California Railroad Commission, which had summoned the company to show cause why its electric rates should not be reduced pending the outcome of hearings on a revised rate schedule, submitted testimony alleging that the company would earn only 7.93 per cent on a historical-cost basis for 1929. The commission alleges that the company will show a return of 8.8 per cent. The Pacific Gas & Electric also brought out at the hearing that, owing to the lack of rainfall on the Western Coast, the consumption of fuel for the manufacture of electricity had been unduly high, thereby increasing the cost of electrical energy.

DISPUTE BETWEEN QUEENS BOROUGH (N. Y.) OFFICIALS AND COMPANY MANAGERS BRINGS SUSPENSION OF WORK.—Sixteen hundred men engaged in removing overhead wires and laying underground ones in the Borough of Queens, New York City, were laid off last week as the result of a controversy between public officials and officers of the New York & Queens Electric Light & Power Company. The company blamed the trouble on the borough officials' refusal to sign excavation permits. Borough President Harvey, on the other hand, said the company had sought permission to install its trans-

formers in a manner of doubtful legality and that the permits were withheld until an opinion could be had from the corporation counsel.

MONUMENT MARKS SPOT WHERE PELTON WATERWHEEL WAS INVENTED.—To mark the place where Lester A. Pelton perfected his famous hydraulic invention of 1878, a monument was recently erected in the old mining town of Camptonville, Calif., on the site of his workshop. The monument is of concrete, 11 ft. high, and is surmounted by one of his early-type waterwheels. A bronze tablet on the face of the shaft was donated by W. M. White, manager of the hydraulic department, Allis-Chalmers Manufacturing Company, Milwaukee.

NEW MERCED FALLS PLANT FOR SAN JOAQUIN COMPANY.—Operations are under way at the Merced Falls plant of the San Joaquin Light & Power Corporation, Fresno, Calif., to replace the present 600-hp. installation with a modern semi-automatic plant capable of generating 4,580 hp. and costing approximately $330,000. It is expected that the new plant will be completed by early summer. The changes in the plant will include enlargement of the dam, which is 500 ft. long and 20 ft. high.

CENTRALIA OVERCOMES MOVEMENT TO PREVENT BUILDING NISQUALLY PLANT.—The City Commission of Centralia, Wash., has so far overcome the legal obstacles mentioned last week as having been placed in its way to prevent resumption of the construction of the city's million-dollar hydro-electric project on the Nisqually River, a motion for a permanent writ of prohibition to restrain the city from passing an ordinance to include the power project costs in the 1930 budget and another motion to have the contracts approved at two city elections declared invalid having been denied by the courts of first instance.

WOULD ENLARGE PLANT ON STANISLAUS RIVER.—The Sierra & San Francisco Power Company and the Pacific Gas & Electric Company, which owns all of the stock of the former company, have applied to the California Railroad Commission for authority to enlarge the Lyons dam and reservoir on the first company's Stanislaus River power project to provide for a storage capacity of 5,500 acre-feet of water instead of 839 acre-feet as at present. The cost of the proposed improvement is estimated at $430,000.

FOUR DAMS ON OUACHITA RIVER A POSSIBILITY.—That the Arkansas Power & Light Company may eventually possess four power dams on the Ouachita River is considered more than a possibility. It now owns the Remmel Dam and is building the Carpenter Dam. When the latter is finished the company may start on a third dam at Blanco Springs, and a fourth one, on a site not named, is already envisioned by enthusiasts. The Carpenter Dam, to cost about $7,000,000, will be of straight gravity section, 1,160 ft. long. It will rise approximately 115 ft. above the bed of the river except in the powerhouse section, where it has been necessary to excavate 50 ft. into solid rock. An unusual feature of this power house is the use of outdoor or all-weather generators with only a light metal roof. Two 40,000-hp. units with room for a third will be installed.

Z CANYON HYDRO PROJECT ONE FOR THE FUTURE, COOPER SAYS.—Development of the proposed Z Canyon twenty-million-dollar hydro-electric project on the Pend Oreille River in northeastern Washington, for the ultimate generation of 760,000 hp., rests with the future, according to Hugh L. Cooper, who recently stopped in Spokane, en route from Russia, where he inspected the Dnieper River project. Mr. Cooper declared that the general uses to which electric power could be put in the district surrounding the project are not yet sufficiently developed to permit its construction. His permit expires in the spring but carries a year's extension privilege.

STEWART MOUNTAIN DAM MAY BE IN SERVICE NEXT MARCH. — Already three months ahead of schedule, the Stewart Mountain Dam on the Salt River in Arizona is expected to be completed about the first of January and to be generating hydro-electric power in March. Stewart Mountain Dam is the third big power dam constructed by the Salt River Valley Water Users' Association below Roosevelt Dam, the other two being at Horse Mesa and Mormon Flats. It will cost, together with its power plant of 18,000 hp., transmission lines and other works, approximately $2,300,000 and represents the last major step in the Water Users' Association's irrigation and hydro-electric development project.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

National Electrical Credit Association—New York Division, Hotel Pennsylvania, New York City, Dec. 10; New England Division, University Club, Boston, Jan. 21. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Engineering Council—Washington, Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington, D. C.

Conference of Electrical Leagues—Westinghouse Lighting Institute, New York, Jan. 13-16. Society for Electrical Development, 420 Lexington Ave., New York.

North Central Division, N.E.L.A.—Commercial Section, St. Paul Hotel, St. Paul, Jan. 20-21; Engineering Section, Nicollet Hotel, Minneapolis, Feb. 24-25. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

American Institute of Electrical Engineers—Winter meeting, New York, January 27-31. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Wholesalers' Association—Pacific Division, Del Monte, Calif., Jan. 31-Feb. 1.

Artistic Lighting Equipment Association—Washington, Feb. 9-15. C. L. Benjamin, 420 Lexington Avenue, New York.

CAPACITY OF HOUSTON COMPANY'S DEEPWATER PLANT TO BE INCREASED.—An increase of more than 50 per cent in the generating capacity of the electric power plant of the Houston Lighting & Power Company at Deepwater has been authorized by that company. The improvements will cost approximately $6,000,000, it is said. When the addition to the plant is completed it will have a capacity of 150,000 kw. The enlargement will require eighteen to twenty months.

PROFIT IN SUBMETERING.—A circular sent out to New York City property owners by a special committee on submetering appointed by the Real Estate Board of New York and the Building Managers and Owners' Association of New York appeals for subscriptions to a fund being collected to defray the cost of fighting the prohibition of submetering "if necessary right through to the Supreme Court." Three per cent of the amount billed for electricity for the past year is mentioned as the right amount, the circular saying: "This, of course, is an insignificant contribution when you realize the losses involved to yourself should the Edison company be successful in eliminating submetering."

EASTERN DISTRICT CONFERENCE OF OKLAHOMA UTILITIES ASSOCIATION.—Addresses covering problems in operating transmission lines and substations, rural electrification, central-station merchandising, selling electric power, credits and collections, servicing electric appliances and recent developments in the industry are scheduled for the Eastern District conference of the Electric Light and Power Division, Oklahoma Utilities Association, to be held at Sapulpa on December 10. Each of these addresses will be followed by discussion. Fred W. Insull, president Public Service Company of Oklahoma, will make a luncheon address on "International Relationship" to the conference members and local business men.

ILLINOIS POWER & LIGHT CONTENDS THAT MINING COMPANY HAS UNLAWFULLY INVADED ITS TERRITORY.—The Circuit Court at Springfield, Ill., is conducting a hearing to determine whether a mining company selling electrical energy wholesale to municipalities is a public utility corporation within the meaning of the Illinois laws. The Illinois Power & Light Corporation has brought suit to enjoin the Consolidated Coal Company of St. Louis from continuing to furnish its excess electricity to the cities of Mount Olive, White City and Staunton, Ill., and from extending such service to other places in central Illinois claimed by the utility as its territory. The three towns named abandoned municipal plants to buy their

energy from the coal company. The Illinois Power & Light Corporation obtained a temporary injunction restraining the Consol Power Company from building a transmission line to Livingston and Williamson, two other towns which sought to buy its power. The electric company contends that the mining company cannot sell power even at wholesale without a certificate of convenience and necessity from the Illinois Commerce Commission.

NORTHERN STATES POWER COMPANY OPENS REMODELED OFFICES AT LA CROSSE, WIS.—Three thousand citizens of La Crosse, Wis., were present at the formal opening of the Northern States Power Company's remodeled office building on November 21. The building, in which the company formerly rented the basement and first floor, was purchased in the summer of 1928 in order to gain larger quarters and has been made over in accordance with the modern ideal of combined practicability and beauty.

INTERNATIONAL PAPER COMPANY BUILDS NEW BRUNSWICK TRANSMISSION LINE IN FAST TIME.—A 132-kv., 100-mile transmission line between Grand Falls, New Brunswick, and Dalhousie, 100 miles away, directly across the province, has just been built by the International Paper Company in exactly eight months, work starting on April 1 and being completed on December 1. It connects the Grand Falls hydro plant on the St. John River with a new pulp and paper mill at Dalhousie. The line, which has the highest voltage ever utilized in the Atlantic Provinces of Canada, penetrates a mountainous and densely wooded territory. In all 607 steel towers 60 ft. in height were erected. At present 40,000 hp. will be transmitted, which will later be raised to 60,000 hp. when the paper plant reaches full production. The line was built by the company's own staff with R. A. Lawther in charge.

WOULD PUT UTILITY COMPANIES IN FISH HATCHERY BUSINESS. — Oregon sportsmen, in the endeavor to solve the problem of game-fish conservation in rivers and streams used as sites for hydro-electric operations, have recommended that hereafter all utility companies contemplating the construction of dams arrange also for the building and maintenance of modern fish hatcheries. The anglers contend that with the utilities operating hatcheries along with their water-power projects any of the fish which may be destroyed by stream obstruction or hydro plants can be replaced by the companies. The State Game Commission, however, has expressed the view that there is no profit in the operation of private fish hatcheries in Oregon, and, this being true, the rules and regulations of the Public Service Commission would not permit of an electric utility undertaking a joint service which would reflect in increased operating expenses with no visible revenue from the additional service.

Recent Court Decisions

RADIO CORPORATION OF AMERICA AND THE CLAYTON ACT.—The United States District Court at Wilmington, Del., has, at the instance of the De Forest Radio Corporation, issued a permanent injunction restraining the Radio Corporation of America from enforcing a clause in its contracts by which it licensed 27 independent manufacturers of receiving sets to use its patents on payment of royalties. The court held that the corporation had violated the Clayton anti-monopoly law. Since the federal radio act provides that a license shall be refused any one adjudged guilty in a federal court of monopoly or using unfair methods of trade, the case attracts interest as inviting action by the Federal Trade Commission or the Federal Radio Commission. The Radio Corporation is affiliated with the General Electric, Westinghouse, American Telephone & Telegraph and other companies.

DEATH FROM SITTING ON MOTOR WHICH WAS IN OPERATION ACCEPTED AS ESTABLISHED.—The Kentucky Court of Appeals has reversed the Workmen's Compensation Board of Kentucky and awarded the estate of Edgar Duncan $4,000 in judgment against the Louisville Gas & Electric Company, which has a coal mine at Echols, Ky. The court held that under the compensation law the death certificate is *prima facie* evidence of the manner in which Duncan met his death. He sat down on a mine motor and was apparently electrocuted, though the defense alleged heart disease as the cause of death, evidence being introduced to show that another miner had sat on the motor and turned on the current without injury. The court pointed out that there was evidence that Duncan was moist from perspiration, that the motor was grounded and that there was no evidence that these conditions existed in the case of the other miner who sat on the motor.

MEANING OF PLANT "CAPACITY" IN CONTRACT FOR POWER.—The Third District Court of Appeal in California has found for the Merced Irrigation District in its suit against the San Joaquin Light & Power Corporation to force the company to accept from it and pay for 32,400 kw. during a brief period under a contract by which the defendant agreed to purchase the entire output of a plant of "about 25,000 kw. capacity." The suit hinged on the meaning of "capacity" in this connection. The reviewing court held that the irrigation district had the right to contend that the word connoted a possible output of 31,250 kw. (at unity power factor instead of the assumed power factor of 80 per cent) and that the difference between 31,250 kw. and 32,400 kw. was covered by the word "about." Technical experts disagreed on the significance to be given to the word as applied to a power plant and the defendant maintained that it means maximum capacity. (281 Pac. 415.)*

NEBRASKA LAW INCREASING UTILITY TAX VALUATIONS IS UPSET.—The Nebraska Supreme Court has vacated the order recently entered by the State Board of Equalization and Assessment which sought to increase by 10 per cent the assessed valuation of all electric light and power companies and by 20 per cent the valuation of all telephone corporations, holding that as the record clearly indicates that this was done without notice to the companies and without an opportunity to be heard, it is in violation of the state law governing the powers of the board and amounts to confiscation (see ELECTRICAL WORLD for October 12, page 755). If the increase had been allowed, electric light companies would have paid taxes on an increase of $2,039,000. The power companies did not join in the appeal to the courts, but the state tax commissioner will accept the finding as binding on all affected by the original order. The Supreme Court holds that a citizen has the right to rely on his sworn assessment return and that the valuations therein cannot be changed by any public officer without a notice to him, without an opportunity for him to be heard and without testimony being taken when a controversy exists. The state claimed that the statute which sets the date for the annual meeting of the board of review and defines the purpose of the meeting is sufficient notice to all taxpayers, but the court disagreed.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

INDIANA COMMISSION ASSERTS JURISDICTION OVER UTILITIES WITH FRANCHISES.—The Indiana Public Service Commission and not a city has jurisdiction over utilities operating under a franchise, according to a decision taken in a recent rate case by the commission. The ruling was an interlocutory order in connection with a petition for an increase in rates. Counsel for the patrons of the utility argued that the state body had no right to assume jurisdiction, contending that the utility operated under a franchise and not an indeterminate permit from the commission. It was the contention that by reason of this the city and not the commission had the right to assume control over rates. The commission, however, directed one of its members to proceed with the hearing and adjust the rates. There are several utilities in Indiana that have not surrendered their franchises and the decision of the commission will set a precedent in cases of this description.

EXCESSIVE PRICE FOR PROPERTY NOT REFLECTED IN RATES.—Granting permission for the Pemigewasset Electric Company to merge with it the Baker River Light & Power Company and West Campton Light & Power Company, the Public Service Commission of New Hampshire said: "It has been the contention of those in opposition to the petition that an excessive price was paid for the stock of the Pemigewasset Electric Company and that this would be reflected in the rates charged. Such a contention is unsound. Rates must be based upon the fair value of the property devoted to the public service irrespective of the cost of such property. It not infrequently happens that an isolated utility can be advantageously purchased by an adjoining utility at a price which only an adjoining utility would be willing to pay. Such transactions have been favored when the combining of the isolated utility with the adjoining utility works to their mutual advantage, but the rates which such utilities would be permitted to charge and collect have no direct relation to the cost, save as that cost is an evidence of value."

News About Men of the Industry

De Forest Chief Engineer for Columbia Management

C. W. De Forest, formerly vice-president of the Union Gas & Electric Company, Cincinnati, in charge of engineering and electrical operation, is now in charge of electrical engineering for the Columbia Engineering & Management Corporation, holding the title of chief engineer. Mr. De Forest is a New Yorker by birth and he obtained his early experience as an employee of the light and power companies of the Metropolis. Starting with the Brooklyn Edison Company in 1896, he later became identified with the United Electric Light & Power Company, New York City. He then entered the Schenectady works of the General Electric Company and subsequently was transferred to the Cincinnati office. He was sent by the General Electric Company to the old Newport power station of the Union Light, Heat & Power Company, Newport, Ky., to install the first 1,000-kw., three-phase engine generator and to install the first series arc lighting system in Newport and Covington. Later he was employed by the Cincinnati, Newport & Covington Light & Traction Company as chief engineer of power stations and master mechanic for the Cincinnati, Newport & Covington Street Railway. After the Columbia company leased the Newport traction company and the Union Gas & Electric Company was brought to Cincinnati, Mr. De Forest was made electrical engineer for the Union Gas & Electric Company and later manager of the electric department. He had supervision of the design and construction of the West End power station in Cincinnati and also of the Columbia power station of the Columbia Power Company, of which company he became vice-president.

Mr. De Forest is the author of several papers on engineering subjects and is active in association work, being a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and chairman of the committee on power generation of the Association of Edison Illuminating Companies.

DON G. MITCHELL, widely known industrial development expert and for several years director of the Industrial Site Service of the McGraw-Hill Publishing Company, New York, has been selected by the Niagara Hudson Power Corporation to head its newly organized industrial development bureau. The bureau will maintain an expert industrial engineering staff, equipped to analyze the specific problems of industrial organizations as well as the peculiar industrial advantages of communities and districts in the state. The head office will be located at Albany, N. Y., with branches in Buffalo and Watertown and local representatives in each of the corporation's offices in cities throughout the state.

W. L. Goodwin Heads Armstrong Electric

William L. Goodwin, whose name has for many years been associated with the electrical industry, has been elected president of the Armstrong Electric & Manufacturing Corporation, Huntington, W. Va., with headquarters in the company's executive offices in New York. Starting in business in California 30 years ago, Mr. Goodwin developed the largest electrical jobbing business in the United States with headquarters in San Francisco. His contributions to the electrical industry in his native state both as a business man and as a leader in the development of business co-operatively drew national attention to him. Coming East, under the sponsorship of the General Electric Company Mr. Goodwin promoted a co-operative merchandising plan for the electrical business which stimulated action for the improvement of electrical trade conditions and aroused the leaders of all branches of the industry to their common concern in market development. This pioneer work led to the election of Mr. Goodwin as operating vice-president of the Society for Electrical Development. From this position he resigned three years ago to undertake private business in the capacity of merchandising counsellor as president of the firm of Goodwin, Morton & Badrian, Inc.

THOMAS A. EDISON received on December 3 the congratulations of the state of New Jersey on his distinguished career. A subcommittee of the committee of 100 named by Governor Larson waited on him in the library of his experimental plant in West Orange and presented resolutions to him signed by the entire committee. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, made the presentation. Mr. and Mrs. Edison departed December 5 for their winter home at Fort Myers, Fla.

PAUL S. DUENWEG, for the past fifteen years general superintendent of the Houston Electric Company, Houston, Tex., has resigned to join the American & Foreign Power Company in the Argentine.

H. M. Beugler Joins Sayer Corporation

Hugh M. Beugler has become associated with the E. Y. Sayer Engineering Corporation, engineers and constructors, New York, in connection with the development of various engineering and construction projects. For many years Mr. Beugler has been engaged in responsible positions on public utility work of a diversified nature with large and smaller companies covering a large portion of the United States. In recent years he has been allied with the management of the Central Hudson Gas & Electric Corporation as operating manager and managing director of physical property development.

Prior to his connection with the Central Hudson organization Mr. Beugler was associated with Day & Zimmermann as general superintendent of construction. Later he was engaged with Ford, Bacon & Davis as operating superintendent on properties of the American Cities Company, operating in Knoxville, Nashville and Memphis, Tenn.; Little Rock, Ark., and Houston, Tex.

E. S. Fields Named Manager of Electrical Department

E. S. Fields, formerly electrical engineer of the Columbia Engineering & Management Corporation in charge of electrical engineering for the properties of the Columbia Gas & Electric Corporation, has been appointed manager of the electrical department of the Union Gas & Electric Company and affiliated companies of the Cincinnati group of properties of the Columbia System. Mr. Fields is a native of Kentucky. He first entered the employ of the Union Gas & Electric Company in 1918 in the construction department. In that same year he was sent to the West End station, remaining there in various capacities until 1923, when he was appointed assistant electrical engineer of the Union Gas & Electric Company. Two years later he was appointed assistant electrical engineer of the Columbia Engineering & Management Corporation and subsequently electrical engineer of that company.

J. P. ALVEY, formerly manager of the Illinois Power & Light Corporation at Jacksonville, has been appointed manager of the Illinois Valley division of the Northern Illinois group with head-

quarters at Ottawa. Prior to his connection at Jacksonville he was identified for a number of years with the Illinois Traction Company, first at Cairo and later at Ottawa.

FRED JOHNSON, branch manager of the St. Louis district office of the Wagner Electric Corporation for 21 years and the Los Angeles office for one year, has been elected to the vice-presidency of the Interstate Electric Company of St. Louis, Mo., manufacturer of carbon arc lamps and various electrical specialties.

H. L. DE RAEMY, managing director of the Société des Ateliers de Constructions Electriques, Lyons, France, has been appointed a chevalier of the French Legion of Honour as a mark of appreciation of his work in advancing the electrical engineering industry in France.

CHARLES P. GOLDING of Cambridge has been appointed superintendent of new business by the Western Massachusetts Companies and will have charge of all promotional work, including advertising and selling. From 1925 to 1927 he studied at the Graduate School of Business Administration of Harvard University and during the summer of these years he worked for the Cambridge Electric Light Company and for Bird & Sons of East Walpole in the engineering department. In 1927 he joined the George Frost Company of Boston and was engaged in organization engineering work in factory and sales department, in charge of inside sales organization, advertising and sales promotion. Since March of this year Mr. Golding has been research assistant in public utility management of the Graduate School of Business Administration of Harvard University engaged in research work in public utility management and operation.

CLAUDE C. SMITH, for the past 20 years managing director of the Bradford & Gettysburg Electric Light & Power Company, an Ohio corporation, which was recently purchased by the United Public Service Company of Chicago, is at present associated with the Liberty Light & Power Company of Richmond, Ind., as assistant to the president, Robert S. Ashe. Mr. Smith is one of the pioneer central station operators in Ohio, entering the electric field in 1889. In the course of his career he has been associated with the Card Electric Company, Mansfield, Ohio; Reliance Machine & Tool Company, Cleveland, and the Stockton Gas & Electric Company, Stockton, Calif. In 1905-07 Mr. Smith was inspector of machinery for the New York Central Railroad at Pittsburgh, Pa., and superintendent of construction for the Ohio Public Service Company. In 1908 he became associated with Robert S. Ashe in the construction and operation of the Bradford & Gettysburg Electric Light & Power Company, Liberty Light & Power Company, Camden Light & Power Company and Cambridge Light & Power Company of Indiana.

D. S. Brown Assumes Broader Duties

D. S. Brown, who has been connected with the public utility industry in Cincinnati since 1913, has been appointed manager of the production department in charge of power plants. While a student in the co-operative course in electrical engineering at the University of Cincinnati he entered the employ of the Cincinnati Traction Company, but, three years later, in 1916, he became identified with the Union Gas & Electric Company. After discharge from military service he was again employed by the Union Gas & Electric Company as an electrician and after receiving the degree of electrical engineer in 1920 h was named assistant superintendent production at the West End station Early in 1923 he was appointed acting superintendent of production and late that year superintendent of production having charge of the boiler and turbin equipment of the power stations. M Brown is active in association work, at the present time being a member of th prime movers committee of the National Electric Light Association.

C. S. WILLIAMS, JR., vice-president of Thomas A. Edison, Inc., has been named chairman of the committee on ways and means of the American Fair Trade Association, New York. Mr. Williams, who is succeeding the late F. B. Caswell, has a broad practical knowledge of the problems of the distribution of standard trademarked articles and a familiarity with the legislative situation gained through personal investigation and official contacts.

Obituary

JOHN C. VAN VLEET, safety engineer of the Buffalo General Electric Company, Buffalo, N. Y., died suddenly at his home in that city October 24. Mr. Van Vleet was originally purchasing agent for the New York State Steel Company, now known as the Donner Steel Company. When ground was broken for the Charles R. Huntley station he was employed by the Stone & Webster Construction Company, which built the original plant for the Buffalo General Electric. It was through his efforts in safety work that the Buffalo utility won the trophy for the best accident record in a contest in 1928.

J. A. VANDEGRIFT, formerly general manager of the Pacific Coast sales activities for the National Lamp Works of the General Electric Company, with headquarters in Oakland, Calif., died in that city November 15, at the age of 69. During the early part of his career Mr. Vandegrift was a carbon lamp manufacturer and this took him to foreign countries, where he sold and installed lighting plants and lamps. Finally he returned to the United States and built and operated a carbon lamp factory in Denver, Colo. About 1903 or 1904 he went to the Pacific Coast to take charge of the Oakland warehouse for the National Electrical Lamp Association, which later became the National Lamp Works of the General Electric Company. About 1910 he took charge of sales, in addition to factory responsibilities, and continued this joint operation until 1914, when he placed the factory operations in other hands and spent all of his time on sales work. In 1924 he retired as general manager of Pacific Coast sales activities. Mr. Vandegrift's intense interest in the development of the electrical industry brought him in close contact with a branches of it.

JAMES F. HARNEY of Laurens, S. C died November 26 in that city. He ha been a resident of Laurens for abo eighteen years and for many years w superintendent of the Reedy Riv Power Company and Sullivan Powe Company, operated under the presidency of former Senator N. B. Dial. When these properties were sold, about two years ago, Mr. Harney was appointed as local manager. He was a native of Spartanburg, S. C.

HARRY WALLACE JEANNIN, vice-president and chief engineer of the Jeannin Electric Company, Toledo, Ohio, died November 19. Mr. Jeannin was born at Cape Girardeau, Mo., in 1869. In 1890 he became manager of the power station at Booneville, Mo. This connection was followed by managerial positions at the power stations at Paragould and Jonesboro, Ark., and in 1896 he was appointed plant manager of the telephone plant at Pine Bluff, Ark. In 1899 he joined the Wagner Electric Company, in whose employ he remained seven years. Subsequent connections included the Century Electric Company, St. Louis, Mo.; the Peerless Electric Company and National Electric Welding Company, Warren, Ohio. Then there followed a period of consulting engineering work, until he joined the American Magneto Company in Toledo, Ohio. In 1919 he organized the Jeannin Electric Company, Toledo. Mr. Jeannin, who was a member of the American Institute of Electrical Engineers, had taken out quite a large number of patents relating to motors, particularly of the repulsion induction type.

Financial and Statistical News

THE BUOYANCY of the utility markets early this week again demonstrated the confidence which the public has in these issues. This was by no means lessened by President Hoover's remarks on regulation.

——A GROUP OF TEN REPRESENTATIVE power and light stocks now (close December 3) average 40 per cent over the low of the October-November break, but they are still 40 per cent under the year's high. In other words, the break amounted to 56 per cent from the year's high and the loss has been reduced to 40 per cent below the year's high, in this group.

——THE ANNOUNCEMENT BY THE New York Stock Exchange of a 49 per cent reduction in the borrowings of its members during November was a bullish factor in the market.

Few Light and Power Bonds in Default

Public utility bonds in default of interest as of November 1, 1929, totaled $235,858,075, as compared with $279,408,475 on November 1, 1928, according to a compilation made by Dow, Jones & Company. Traction companies constitute the major portion of defaulted obligations, the amount recorded for electric light and power companies being insignificant. Only five companies of this type appear in the tabulation: Carolina Mountain Power to the amount of $550,000; Intermountain Water & Power Company to the amount of $557,000; Mississippi Valley Railway & Power to the amount of $800,000; Tacoma Railway & Power to the amount of $1,236,000 and West Virginia Light, Heat & Power to the amount of $1,042,800. It is interesting to observe that the majority of these companies are not strictly light and power but have railway and water elements tied in.

Extra and Larger Dividends

Duke Power Company has declared a 2 per cent stock dividend on the common stock and the regular quarterly dividends of 1¼ per cent on the common and 1¾ per cent on the preferred stocks, all payable January 2 to holders of record December 14. At this time last year the company declared an extra cash dividend of 1 per cent on the common stock.

Pennsylvania Water & Power Company has declared a quarterly dividend of 75 cents per share on the capital stock, no par value, payable January 2 to holders of record December 13. The company paid quarterly dividends of 62½ cents per share from October 1, 1927, to October 1, 1929, inclusive.

Ingersoll-Rand Company has declared an extra dividend of $1 per share on the common stock, no par value, payable December 31 to holders of record December 9. An extra of like amount and the regular quarterly of $1 per share are payable on the common stock on December 2. On June 1 last an extra cash distribution of $1.25 per share was made and the regular dividend rate was increased from 75 cents to $2 per share quarterly.

Southern Canada Power Gross up 15.8 per Cent

Reflecting to some extent the status of the power and light industry in Canada, the Southern Canada Power Company has shown a yearly growth in earnings well above the average for similar companies in the United States. Gross earnings rose 15.8 per cent and net 12 per cent for the company's fiscal year ended September 30. Electric revenue taken alone increased about 14 per cent. Kilowatt-hour output is up 12 per cent.

Southern Canada Power has pushed industrial development within its area in an aggressive manner and during the past year about twenty industries have moved into its territory. It is interesting that Southern Canada Power Company for the first time in its history has earned approximately 5 per cent on its assets of $24,084,771. There were two voluntary rate reductions during the year.

Seattle Municipal System Makes $2,000,000 Offering

Gold bonds to the amount of $2,000,000 were offered during the past week by the city of Seattle, Wash., municipal light and power plant and system at 100 and interest. These 5 per cent securities were dated October 1, 1929. Bonds totaling $80,000 will mature each October 1, 1935 to 1959, inclusive. These bonds are issued by the city of Seattle for the purpose of making certain additions and extensions to the existing municipal light and power plant and system, and are valid and legally binding obligations of the city of Seattle, payable, both principal and interest, together with bonds previously issued, from the revenues of the municipal light and power plant and system. The city of Seattle pledges itself to establish and maintain such rates for electric energy as will provide a sufficient amount to pay interest and principal of these bonds when due, and all operating charges and depreciation of the municipal light and power plant and system.

Foshay Receivership Shows $10,500,000 Indebtedness

Preliminary findings in the receivership of the W. B. Foshay Company of Minneapolis and its subsidiaries, filed with the United States District Court, shows that indebtedness thus far discovered against the Public Utilities Consolidated Corporation, holding company for the Foshay utility properties, totals about $10,500,000, and that its assets include a claim of $6,000,000 against the parent concern, the W. B. Foshay Company.

The statement describes the indebtedness of the W. B. Foshay Company to the utilities corporation as "of somewhat doubtful value," and adds that "it may be an investigation of the affairs of the W. B. Foshay Company will disclose that certain of the indebtedness of that company is illegal and unenforceable."

The W. B. Foshay Company still owes the Public Utilities Consolidated Corporation about $4,000,000 in payment on contracts for purchase of utility plants. These contracts involve only concerns which the Foshay company agreed to buy and for which it had not completed payment.

Buying of Government Securities Eased Credit

The drastic recession in the prices of stocks threw a tremendous burden upon the banking institutions of New York City, which they were fortunately able to carry, says the Guaranty Survey, published by the Guaranty Trust Company, New York. Due to the policy of the New York Federal Reserve Bank in safeguarding its credit resources, it was in a position to meet the emergency forced upon it and its member banks. Through its policy of raising the rediscount rate early in August and of buying bills later, the banks of New York City were practically out of debt when the heavy demands caused by the market recession were forced upon them. Their rediscounts had decreased from more than $300,000,000 early in August to less

than $100,000,000 on October 1. As a result, they met the extraordinary demands for funds which were precipitated by the falling stock market and the withdrawal of money from New York with their borrowing capacity unimpaired. The assurance given them that the New York Federal Reserve Bank was in a position to supply them with funds freely was the great stabilizing factor of the money market in that hour of need, says the statement.

Within the span of one week during the crisis the Federal Reserve Bank of New York bought more than $150,000,000 worth of government securities. By this process the heavy withdrawal of funds was met and the New York banks are again rediscounting a relatively small amount. While this is true of New York and Boston, it is not so true in other districts.

Construction Program for 1930 Exceeds All Precedent

Utilities in All Sections Plan to Overtake Building and Improvement Needs in Many Cases Overdue

THE largest construction budget in the history of the electrical industry is planned for 1930, utility executives told President Hoover in Washington last week. The budget for the utility industry as a whole approximates $1,500,000,000 and an additional $410,000,000 for maintenance. Power and light will account for some $865,000,000, according to M. S. Sloan, president of the National Electric Light Association. Substantial commitments have already been entered into and many contracts for equipment and materials have been placed.

Among the larger systems, the North American Company's subsidiaries are providing for 14 per cent more expenditures for additions to plants and systems than will be spent in 1929, according to Frank L. Dame, president. "Estimates of 1930 construction budgets for the North American System," Mr. Dame said, "aggregate upward of $100,000,000 for new work authorized, including new projects and amounts carried over from this year in connection with large construction programs falling naturally into two or more calendar years. Of this amount it is estimated that about $57,000,000 will be expended during 1930, as compared with $50,000,000 expended during 1929. The figures do not include expenditures for maintenance, which will approximate $11,000,000 for 1930.

"These estimates provide for largely increased activities in the various groups of properties, especially in the construction of additions to distribution systems, supplementing the several major programs of new plant construction and additions actually completed during 1929. The latter included a new steam-electric generating plant at San Francisco and large additions to the Cahokia plant, near St. Louis; Avon plant, near Cleveland; Lakeside plant, at Milwaukee, and Benning plant, at Washington. Substantial expenditures were also made for work under way on a new steam-electric generating plant at Ashtabula, Ohio, and the hydro-electric plant and dam on the Osage River at Bagnell, Mo."

Companies in the United States whose operations are supervised by the Electric Bond & Share Company have estimated cash expenditures for the year 1930 aggregating $241,400,000. Of this estimated total, $125,400,000 consists of new construction and the balance of $116,000,000 consists of the cost of operating labor, materials and supplies and taxes. The companies whose total new construction will aggregate an estimated figure of $125,400,000 are the subsidiaries of the American Power & Light Company, the Electric Power & Light Corporation and the National Power & Light Company. The estimated cash expenditures for new construction by each group follow: American Power & Light $45,200,000, Electric Power & Light $38,300,000 and National Power & Light $41,900,000.

The above program embraces much large construction work which cannot be completed in the year 1930.

Heavy Expenditures in New England

Although definite figures have not yet been received as to contemplated expenditures of the Edison Electric Illuminating Company of Boston, Charles L. Edgar, president, said recently that power companies in New England have reported expenditures in 1929 of $60,000,000 and that the total for 1930 would be "considerably in excess of that of 1929." Mr. Edgar referred to two outstanding power developments, the Bingham Dam power station on the Kennebec River and the Fifteen-Mile Falls power station on the Connecticut River.

New England Power Association, controlled by International Hydro-Electric System, a division of the International Paper & Power Company, is spending $42,000,000 for construction in 1929 and 1930. The association's program involving expenditures was mapped out some time ago and has not been curtailed as a result of the recent action of the securities markets.

New construction is taking $40,250,000 of this amount, or 96 per cent, while the balance, $1,750,000, is being expended for replacements. In addition to these appropriations for construction, the association's program calls for an outlay on maintenance of existing plants of $6,900,000 in the two years.

Next year's expenditures of the association on construction work will aggregate about $20,000,000, which will be distributed as follows: $11,000,000 in New Hampshire and Vermont, $6,000,000 in Massachusetts and $3,000,000 in Rhode Island.

A large portion of the outlay is going toward the construction of the association's Lower Fifteen-Mile Falls hydro-electric development on the upper Connecticut River. This plant will have a capacity of 200,000 hp. and is expected to be in operation October 1 of next year.

The output of electric energy by the association month by month this year has shown steady growth over last year, and the demand for energy continues to increase at a very healthy rate. In the first nine months the output of the plants of the association was 14.9 per cent over their output in the corresponding period of last year. This compares with an increase of 11.5 per cent in the output of all utility power plants in the United States in the same period.

Large Program in Middle West

According to statement received from the Middle West, construction and improvement will be exceedingly active in 1930. Illinois public utility companies are planning to spend nearly $165,000,000 in new construction, improvement and extensions, according to a canvass recently completed.

Standard Gas & Electric Company plans to invest about $63,700,000, according to a statement made by John J. O'Brien, president of the company. This figure, Mr. O'Brien pointed out, is somewhat lower than the actual construction figure for 1929, including the carryovers or incompleted construction from the preceding year. The total construction budget of these companies for 1929 amounted to approximately $66,100,000, which included carryovers of $16,800,000. The construction budget of $63,700,000 for the calendar year 1930 will include carryovers from 1929 estimated at only $13,000,000. These budget figures are based upon the best estimates we have been able to make of future conditions and requirements.

Mr. O'Brien pointed out that five steam-electric generating plants with a combined capacity of 135,000 kw. are now under construction by the Byllesby Engineering & Management Corporation for four companies in the Standard Gas & Electric Company system. The five major engineering projects represent the largest amount of steam-electric generating capacity under construction at one time in the history of the Byllesby organization. The Northern States Power Company, subsidiary of the Standard Gas & Electric Company, will spend $10,000,000 during 1930 for new construction, additions and extensions in plant and equipment. This money will be spent in Minneapolis, St. Paul and throughout Minnesota, Wis-

Current Earnings Reports of Electric Light and Power Companies

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
Central Illinois Light (Year ended October 31)					
Gross earnings	$5,063,797	$4,700,477	7.7	58	59
Net earnings	2,112,063	1,909,616	10.6	..	..
Commonwealth & Southern and subs. (Year ended October 31)					
Gross earnings	146,902,994	135,030,530	8.7	49	50
Net earnings	75,105,863	67,721,557	10.9	..	..
Consumers Power (Year ended Oct 31)					
Gross earnings	33,320,037	29,693,991	12.2	49	50
Net earnings	16,892,816	14,866,271	13.6	..	..
Illinois Power (Year ended October 31)					
Gross earnings	2,875,113	2,713,701	5.9	63	65
Net earnings	1,053,524	930,565	2.2	..	..
National Power & Light (Year ended September 30)					
Gross earnings	80,668,264	78,556,656	2.7	56	56
Net earnings	35,944,390	34,605,756	3.9	..	..
Nevada-California Electric and subs. (Year ended October 31)					
Gross earnings	5,623,335	5,392,731	4.3	48	43
Net earnings	2,901,868	3,086,336	—6.0	..	..
Ohio Edison (Year ended October 31)					
Gross earnings	2,270,716	2,083,392	9.0	48	52
Net earnings	1,186,129	1,004,045	18.2	..	..
Southern California Edison (Year ended October 31)					
Gross earnings	$39,512,954	$34,323,240	15.0	33	33
Net earnings	26,280,221	23,113,978	14.0	..	..
Southern Indiana Gas & Elec. (Year ended October 31)					
Gross earnings	3,394,841	3,132,394	8.3	57	57
Net earnings	1,457,452	1,348,435	8.1	..	..
Standard Gas & Elec. System (Year ended September 30)					
Gross earnings	170,982,656	162,990,387	4.9	..	..
Net earnings	84,298,233	78,401,187	7.5	..	..
Standard Power & Light (Year ended September 30)					
Gross earnings	72,642,432	71,190,396	2.0	..	..
Net earnings	34,220,255	31,012,518	10.3	..	..
Tennessee Electric Power (Year ended October 31)					
Gross earnings	14,369,892	13,253,475	8.5	51	52
Net earnings	6,984,285	6,343,063	10.1	..	..
United Light & Power & subs. (Year ended October 31)					
Gross earnings	94,635,311	89,047,736	6.2	58	59
Net earnings	39,417,224	36,554,163	7.8	..	..

consin and the Dakotas. The estimate is approximate, Robert F. Pack, vice-president, explains, since all details have not been completed. Major items are the building of a 20,000-kw. steam generating station at Granite Falls, Minn., erection of an office building in St. Paul, material additions to the steam power plants at Fargo and Minot, N. D., additions to the Aldrich and Wilson electric substations in Minneapolis and an addition to the generating capacity at the Riverside steam station in Minneapolis.

The Pacific Gas & Electric Company will spend $35,000,000 during 1930 on construction of electric and gas projects, and normal extensions and improvements throughout its system will bring the year's building budget up to the record sum of $40,000,000, according to A. F. Hockenbeamer, president. The largest items in this program are $12,000,000 which will be devoted to complete the natural-gas pipe line system from the Kettleman Hills fields to the San Francisco Bay region and $16,000,000 which will be spent on the Mokelumne River hydro-electric project. The ultimate cost of the Mokelumne project will be $36,000,000 and it is expected that it will add, when completed in 1931 228,000 hp. to the company's system. During 1930 the company will spend $3,000,000 on construction of the Mokelumne-Newark transmission line, and an additional $1,786,000 will be spent enlarging the Newark substation to handle the additional load of electricity. The budget also calls for the expenditure of $4,000,000 on the reconstruction of station "A," the steam-electric generating plant in San Francisco. This item is part of a five-year program of rebuilding the station and raising its capacity of 300,000 hp.

Official announcement comes from Pittsburgh that the Aluminum Company of America will expend $50,000,000 in 1930. The company's budget for 1929 was $33,000,000, but only $15,000,000 of this will have been spent in this calendar year, leaving $18,000,000 to be carried over into 1930. In addition to this the budget for next year will carry $12,000,000 for the development of power needed in the production of pig aluminum and $20,000,000 for manufacturing facilities.

Asserting that he and his associates saw nothing in the recent market disturbance to affect the destinies of the utilities with which he is identified, Samuel Insull told the Economic Club of Chicago, in an address made on December 3, that these utilities would spend $200,000,000 for extensions and improvements in 1930.

"To know where we stand we have surveyed business conditions," said Mr. Insull. "We are convinced that the credit situation of the country is good, that collections are practically normal, that there is no extraordinary accumulation of inventories, that the market disturbance was not caused by a shortage of money, that money in fact is plentiful. We know that the success of our business depends upon the success of other businesses. We know that the extension of the use of our service depends upon the financial ability of the every-day householder to use and pay for that service."

Insurance Companies Increase Public Utility Holdings

Investments in public utility bonds by 25 of the larger life insurance companies in the United States and Canada continue to increase, while their holdings of railroad, government and municipal bonds show a decline, according to an analysis prepared by Bonbright & Company. Figures based on the 1928 reports of these companies show that $200,000,000 of public utility bonds were added to their portfolios out of a $500,000,000 increase in total bond holdings and that utility bonds now comprise 24.6 per cent of their total bond investments of $5,717,703,115. The accompanying table shows the distribution of bond investments of the 25 leading companies at the end of 1928.

	Public Utility (Per Cent)	Government and Municipal (Per Cent)	Railroad (Per Cent)	Industrial and Miscellaneous (Per Cent)
Metropolitan Life	21.8	16.8	56.4	5.0
Prudential	27.8	22.3	42.0	7.9
New York Life	22.5	17.6	57.8	2.1
Equitable Life Assurance	33.0	6.2	59.2	1.6
Mutual Life	8.3	19.4	70.3	2.0
Northwestern Mutual	8.4	32.3	59.3	..
Travelers	19.1	57.5	21.0	2.4
Mutual Benefit Life	25.3	9.2	63.1	2.4
John Hancock Mutual	36.5	23.9	39.2	0.4
Sun Life Assurance of Canada	36.5*	11.1	2.0	50.4
Penn Mutual Life	17.9	24.3	50.8	7.0
Aetna Life	29.6	26.7	39.6	4.1
Massachusetts Mutual	48.3	1.9	49.5	0.3
Union Central	..	100.0	..	..
Provident Mutual Life	13.2	5.7	80.0	1.1
New England Mutual	39.0	19.6	40.2	1.2
Connecticut Mutual	41.7	20.8	34.7	2.8
Canada Life Assurance	23.3	60.1	4.6	12.0
Pacific Mutual	48.5	12.2	0.5	38.8
State Mutual	31.1	32.1	36.1	0.7
Phoenix Mutual	47.4	15.5	33.0	4.1
National Life	27.2	72.8	..	..
Bankers Life	..	100.0	..	..
Connecticut General	71.4	5.2	22.4	1.0
Great West Life	6.1	75.3	0.4	18.2
Aggregate	24.6	21.0	47.3	7.1

*Includes stocks.

Business News and Market Conditions

Motive Power of Modern Industry Pictured at Power Show

VISITORS to the eighth National Exposition of Power and Mechanical Engineering, held at the Grand Central Palace, New York, this week, were privileged to see a cross-section of the motive power of the nation's industry. Looking beyond the mere machines one saw the basis of our twentieth century mechanized civilization. Collectively, the 500 exhibits presented an amazing picture of the result of human ingenuity in directing power to do man's work.

The past year has evidently been a fruitful one along these lines. There were more improvements and new designs than for some years. These were not alone in the field of large power equipment. They included small precision instruments, heating plants, new chemicals, metals and many other developments related to the use of power. There were carefully worked out illustrations of the method of handling the power supply for large buildings, such as hotels. There were forced draft blowers and stokers.

One exhibit included a multi-speed squirrel-cage, polyphase, induction motor, with a new arrangement of the winding in the stator, giving constant torque, constant horsepower or variable torque, according to the particular operation required. There were also several new developments in control, recording and regulating equipment.

In the field of precision instruments one device which attracted interest was an electric gage originally designed for measuring the bore of a crankpin hole. It is so constructed as to have a minimum of moving parts and yet it permits routine gaging operations to be conducted with great rapidity and accuracy. It can also be used for external diameter measurements and also to measure the depth of shoulders. A difference of one ten-thousandth of an inch deflects an ammeter needle one inch.

Another development of general interest was a waterproof and dustproof cable about the thickness of a lead pencil which, when compressed at any point along its length, completes an electric circuit. The cable is one continuous switch along its entire length, whether a few feet or much longer.

A new device in home heating which is said to insure a constant, uniform supply of warmed, humidified and cleaned air throughout the house was also shown. This is not merely a ventilating system to be attached to the furnace nor a device to evaporate water into the air but a complete self-contained system.

In connection with power for large buildings one interesting feature was the use of an eight-cylinder Diesel engine in combination with steam engines in the power plant, in order to give additional assurance against breakdown and at the same time to improve the summer heat balance by cutting down the supply of exhaust steam.

More Welding Sets Sold

Sales of welding sets for the first half of 1929, according to *N.E.M.A. News*, were 2,106, against 1,268 for the first half of 1928. Totals by months were as shown in the accompanying table.

Sales of Single-Operator Variable Voltage Sets

(Total Orders Received)

		No. Units	No. Companies
Jan.	1928	128	6
Feb.		172	6
Mar.		285	6
Apr		239	6
May		238	5
June		206	5
July		294	5
Aug.		228	5
Sept		234	5
Oct.		297	5
Nov.		218	6
Dec.		291	6
	Total	2,830	
Jan.	1929	281	6
Feb.		328	6
Mar		443	6
Apr.		371	6
May		387	6
June		296	6
	Total	2,106	

Equipment Business Has Held Up Well

The executives of the leading electrical manufacturing companies do not anticipate any substantial reduction in business as a result of the recent stock liquidation movement. A representative group of these executives were approached by the ELECTRICAL WORLD for their opinion on the general situation and the outlook for their individual companies.

While some of these manufacturers expressed the belief that a temporary recession was very probable, none of them indicated any fears for future business. The following opinion is probably most representative:

"I can foresee no great detrimental effect of the present stock market crash on the general sales and distribution of electrical goods. There will be for a while, very naturally, some timidity on the part of buyers, particularly of luxuries. It is a fact, however, that very few financial statements of concerns listed on the Stock Exchange showed decrease in earning power, and in no case that I have heard of are payments to stockholders any less. This means that income to the average security holders has not been affected, and while many may have lost on transactions involving the sale of their property, others in a like manner have gained.

"Attendant to a panicky condition such as we are going through in the market is always a wave of insecurity and this may temporarily even affect utility and industrial purchases. This, however, we do not expect."

While one manufacturer stated that his company experienced a decided falling off in orders for about a week, the majority did not experience this temporary recession and do not anticipate any permanent decline.

According to a number of these manufacturers, however, the close of the month marked a substantial reduction in orders and also in inquiries. Of this group, however, practically every one felt strongly convinced that the recession was temporary and that the outlook for 1930 was decidedly good.

Metal Manufacturers Form an Association

A business association of a number of the leading manufacturers of metals produced in electric furnaces is indicated today by the chartering by the Secretary of State of the Electric Metals Association, Inc., as a membership corporation without capital stock. The principal office of the corporation will be located at 661 Allen Street, Syracuse. McKercher & Link, 17 John Street, New York City, are the attorneys who filed the papers.

The objects stated in the certificate of incorporation include:

To promote general improvement in the manufacture and sale of metals produced in electric furnaces and by the electrical process.

To protect the industry and to promote the growth thereof through the expansion of its opportunities and by securing a wider market for its products.

To assist in research and study of methods and processes to the end that those engaged in the industry may conduct their business more intelligently.

New York Metal Market Prices

	Nov. 26, 1929 Cents per Pound	Dec. 4, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am.S. & R.price	6.25	6.25
Antimony	8¼	8¼
Nickel, ingot	35	35
Zinc, spot	6.50	6.35
Tin, straits	41.75	38¼
Aluminum, 99 per cent	24.30	24.30

Market Conditions

THE RECESSION in electrical equipment orders throughout the East continues in the industrial field. Utility orders are more numerous and electric railway business is especially active throughout the Eastern district.

——THROUGHOUT THE Middle West and Southwest electrical business is keeping up a good average, probably over that of last year.

——WHILE BUYING was temporarily interrupted in the Pacific Coast area, the utilities are planning a huge budget for 1930 which will cover all lines of equipment. Industrial buying has improved. Motor sales are active.

EASTERN

WITH AN encouraging outlook, based upon projected central station and industrial developments, electrical equipment account is marking time in the Eastern district.

THE SAG in orders and inquiries continues, but more pronounced in the industrial field than for utility business, which has a fair amount of current transactions.

MEANTIME, electric railway business is showing a strong tone, both for immediate and future commitments, and marine demand is following as a close second.

Electric locomotive sales are a bright spot in the present situation. The Michigan Central Railroad has placed an order for four oil-electric units with the American Locomotive Company, General Electric Company and Ingersoll-Rand Company. The Illinois Terminal Company, Chicago, has contracted for a combination electric locomotive to be built by the St. Louis Car Company and General Electric Company. The Southern Pacific Company will be in the market for two electric locomotives in the near future, and the New York, New Haven & Hartford Railroad Company is scheduling a purchase of ten such units in 1930. The Erie Railroad Company has closed with the Westinghouse Electric & Manufacturing Company for a 600-hp. oil-electric rail car, the body to be constructed by the St. Louis Car Company.

A New Jersey manufacturer of prime movers says that while business has shown a tendency to ease during the past few weeks, the swelling volume of small orders gives excellent promise for the future. A New York maker has secured an order for substation equipment for the New York subway system to cost $100,000. A utility company in western Pennsylvania has ordered a quantity of switchgear to an amount of $55,000. A power company in North Carolina has purchased similar equipment from a New York manufacturer to cost $175,000. An Illinois manufacturer of generating sets has secured a contract from a municipality in Texas for such units and auxiliaries to cost more than $300,000. A power company in Connecticut has purchased transformers from a New York producer to the amount of $35,000. A manufacturer of electric cranes and hoists states that business is holding up well and that there has been no noticeable decline on account of the stock market reaction; business is well distributed over a number of industries, with the automobile line only showing a tendency to lag. A maker of transmission line equipment reports sizable orders as a result of railway electrification programs and looks for early future business from that quarter; volume sales for November exceeded those for the same month of a year ago.

CONSTRUCTION PROJECTS

United Electric Light & Power Company, New York, will build an addition to steam department at generating plant on Locust Avenue. Corning Glass Company, Corning, N. Y., has approved plans for an addition to cost $600,000. State Agricultural School, Industry, N. Y., plans fourteen one-story trade school buildings. United States Rubber Company, New York, will carry out an expansion program at plant at Detroit, Mich., reported to cost more than $250,000. International Paper Company, New York, contemplates a pulp mill at Chatham, N. B., reported to cost over $1,000,000. Brooklyn Borough Gas Company, Brooklyn, N. Y., will build an equipment storage and distributing plant, with mechanical shop, to cost about $300,000. Federal Shipbuilding & Dry Dock Company, Kearny, N. J., will carry out an expansion and improvement program to cost over $175,000. Beckwith-Chandler Company, Newark, N. J., is having revised plans prepared for an addition to paint manufacturing plant to cost $100,000. Board of Education, Newark, N. J., will receive bids until December 12 for electrical supplies, electric time clocks, machine shop and woodworking machinery, and other electrical and mechanical equipment. Commissioner of Institutions and Agencies, Trenton, N. J., will receive bids until December 16 for turbine-driven generators. Alan Wood Steel Company, Conshohocken, Pa., will carry out an expansion and improvement program at iron ore properties at Wharton and Oxford, N. J., to cost over $500,000. The Harrisburg Railways Company, Harrisburg, Pa., plans an expansion program to cost $350,000. Aluminum Company of America, Inc., Pittsburgh, Pa., will expend about $50,000,000 in extensions and improvements in mills during coming year, of which close to $12,000,000, will be used for development of power facilities, including hydro-electric generating stations. Blaw-Knox Company, Pittsburgh, Pa., will carry out an expansion program at steel mills to cost $250,000. Apollo Steel Company, Apollo, Pa., will proceed with extensions and improvements in mills to cost $750,000. E. I. du Pont de Nemours & Company, Wilmington, Del., are arranging a fund of $25,000,000, for chemical, rayon, celluloid and kindred plant expansion in 1930, in different parts of the country. Eastern Rolling Mill Company, Baltimore, Md., has approved plans for additions and improvements in plant to cost $300,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until December 17 for 98 motors for different industrial service, with controllers, etc. (Schedule 2309). Department of Commerce, Washington, D. C., will receive bids until December 20 for electric airway beacons on the Washington-Pittsburgh section of Washington-Cleveland airway. Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until December 11 for automatic stoker for local naval research laboratory (Specification 6040); also, for refrigerating plant (no closing date stated) for naval air base, Pearl Harbor, T.H. (Specification 6005.)

SOUTHEAST

REASONABLY satisfactory conditions continue in the electrical field in the Southeast, with no outstanding features to be noted.

THE LARGEST central station order reported was from Georgia for feeder regulators amounting to $20,000.

A NUMBER of interesting wire orders were placed, the largest being for 163,000 lb. of weatherproof solid and stranded copper from a Georgia company.

Other wire orders were from Georgia for 40,000 lb. of No. 4 bare solid copper, 96,000 lb. of bare and weatherproof copper from a South Carolina company and 35,000 lb. of bare and weatherproof copper for a South Georgia company. A steel company in Alabama ordered construction cable last week amounting to approximately $40,000 and an automobile assembling plant in Georgia is ordering electrical materials aggregating $4,000 on account of additional equipment being installed in the plant. Lighting activities, including aviation, street, indoor and outdoor lighting, have been satisfactory over the territory for the past month or more, and jobbers report Christmas buying in reasonably good volume. The Southern Bell Telephone & Telegraph Company has announced a $35,000,000 expansion and improvement budget for the Southeast in 1930.

CONSTRUCTION PROJECTS

West Virginia Coal & Coke Company, Huntington, W. Va., plans extensions and improvements, and installation of electrical equipment at mining properties at Logan, W. Va., reported to cost more than $100,000. Wilson, N. C., plans extensions and improvements in municipal electric light and power plant to cost $300,000. South Carolina Power Company, Charleston, S. C., is considering construction of transmission line from Augusta to Fairfax; a

power substation is planned at Beaufort, S. C. Laurel, Miss., plans installation of floodlighting system and beacon lamps at proposed municipal airport, entire project to cost $400,000. Mississippi Power Company, Gulfport, Miss., plans power substation at Walthall, Miss., and installation of distributing system, reported to cost $40,000. Alabama Power Company, Birmingham, Ala., plans transmission line in Escanabia, and Monroe Counties, about 25 miles. Crane Company, Chicago, Ill., manufacturer of plumbing equipment and supplies, will build a factory branch and distributing plant at Jacksonville, Fla., to cost $100,000.

Pacific Coast

CALIFORNIA UTILITIES responded heartily to President Hoover's appeal. The Southern Pacific announced a $26,000,000 construction program, including much new double tracking; Pacific Gas & Electric announced a $40,000,000 Mokelumne project, total 86,000 hp., with $10,000,000 to be spent in 1930; the Pacific Telephone & Telegraph Company will spend $330,000,000 on the Pacific Coast in the next five years, with a $65,000,000 expenditure in 1930.

Railroad buying is heavy and includes heaters for interurban cars, carloads of iron wire, telephone cable and heavy stock orders for all standard electrical supplies. Power company buying is especially heavy.

Industrial buying is markedly better, the outstanding order covering $30,000 worth of synchronous motors and circuit breakers for an Arizona copper mine, mining business having been very quiet since the spring copper flurry. The week's largest order covers $500,000 Westinghouse ship propulsion equipment sold out of the San Francisco office for a Newport News installation.

Although sales volumes have slowed down materially on account of approaching holidays, there were some good orders placed last week in the Puget Sound district, including one 5,000-kw. turbine, two metal-clad switchboards, 200 motors from 250 hp. down, compressors and pumps for a pulp and paper mill being built by the Washington Pulp & Paper Company at Port Angeles, Wash. The city of Seattle bought one 200-amp., 7,500 volt oil circuit breaker and one 333-volt outdoor type transformer. Motor sales included 25 motors from 30 hp. down to a plywood and veneer plant and twelve machines from 75 hp. down to a sawmill. Another jobber reported the sale of 25 small pumping units to irrigation districts east of mountains, apparatus equipped with 5-hp. motors. Bids opened for furnishing about $20,000 worth of motors, ranging from 100 hp. down, for a grain elevator for the port of Tacoma and specifications are out for an initial order of 25 motors, ranging from 300 hp. down, for the sawmill unit of a pulp and sawmill being built in Everett, Wash., for the Puget Sound Pulp & Timber Company. Board of contracts and awards, Tacoma, is taking bids for switchboards, instrument transformers and carrier telephone equipment, to be opened January 2, involving approximately $20,000, and the city of Seattle is taking bids for 10,200 crossarms. British Columbia Electric Railway Company awarded a contract to the Vancouver Engineering Works, Ltd., for fabrication and installation of a new steel penstock at Jordan River plant, involving $386,000. Power and storage developments involving expenditure of $4,000,000 planned by the West Kootenay Power Company, Ltd., will be started early in 1930, it is stated.

CONSTRUCTION PROJECTS

The Pacific Gas & Electric Company, San Francisco, Calif., plans hydro-electric power plant on Mokelumne River to cost about $15,000,000, with transmission system. The Shell Development Company, operated by the Shell Oil Company, San Francisco, Calif., will build an electric-operated nitrogen fixation plant at Long Beach, Calif., to cost $250,000. The Water and Power Bureau of the city of Los Angeles, Calif., will receive bids until December 19, for porcelain insulators and hardware for one year. The Readymix Concrete Company, San Francisco, Calif., has plans for a plant to cost $100,000. Gustine, Calif., plans installation of ornamental lighting system. The California-Oregon Power Company, Medford, Ore., has plans for a transmission line from Klamath Falls to Bonanza, Ore., about 18 miles, to operate at 38,000 volts. North Bend, Ore., plans ornamental street-lighting system. The Sunset Pacific Oil Company, Seattle Wash., plans storage and distributing plant to cost about $75,000. F. R. Wood of the Temple Fuel Company, Trinidad, Colo., plans coal tar and coking plant to cost about $100,000.

Southwest

MANUFACTURERS have not finished checking up November business, but several report the volume to be above last year.

CENTRAL-STATION buying is holding up and construction materials are moving at a fair rate.

Contract was closed for additional substation switching equipment for a Southern power company for $20,000. A complete "whiteway" equipment for an Illinois town, including light standards and underground cable, costing $7,000 is the only other order of contract size reported.

CONSTRUCTION PROJECTS

J. R. Brockman Manufacturing Company, St. Louis, Mo., plans addition to pipe and pipe-bend manufacturing plant to cost $100,000. Milk Products Company, Hiawatha, Kan., plans plant to cost about $200,000. Stillwater, Okla., contemplates the installation of floodlighting system and beacon lamps at proposed municipal airport. Oklahoma Gas & Electric Company, Oklahoma City, Okla., is said to be planning construction of steam-operated electric generating plant with capacity of 30,000 kw., in connection with an expansion and improvement program for 1930, to cost $10,000,000. Bell Oil & Gas Company, Tulsa, Okla., plans oil refinery near Pampa, Tex., to cost $100,000. Arkansas Power & Light Company, Pine Bluff, Ark., will install an ornamental lighting system at Camden, Ark. Central Power & Light Company, San Antonio, Tex., plans transmission line from Marfia to the Big Bend district to operate at 11,000 volts, about 23 miles. Rio Grande Oil Company, El Paso, Tex., plans refining plant in 1930 to cost $1,500,000. Dr. Pepper Company, Dallas, Tex., will build a bottling plant to cost $140,000. Perry Burrus Elevators, Inc., Dallas, Tex., will build an addition to grain elevator to cost $1,200,000. Texas Milk Products Company, Marshall, Tex., has approved plans for a milk processing plant at Mount Pleasant, Tex., to cost $175,000. Baton Rouge, La., plans installation of floodlighting system and beacon lamps at proposed municipal airport to cost $100,000.

Middle West

FROM PRESENT indications the month of November just closed will show a normal increase in business, as far as the Middle West section is concerned.

STEEL AND AUTOMOTIVE INDUSTRIES are in a healthy condition.

INDUSTRIAL ACTIVITY continues to show the results of seasonal demand; the various utility companies have completed a large amount of their construction schedules, although plans are being made to continue, weather permitting, at the same rate throughout the winter.

Some apparatus purchasing is going on and investment budgets are being prepared for the coming year. Some very large inquiries for copper busbar and insulated cables are out, one utility being in the market for paper and lead covered cable valued at $2,000,000.

The electrical jobber, as a whole, is fairly well satisfied with the volume of business obtained thus far this year. Inventories are low and in most cases sales have shown an increase. Given a normal holiday season, the year is expected to close well.

CONSTRUCTION PROJECTS

Kalamazoo, Mich., contemplates installation of floodlighting system and beacon lamps at municipal airport. Bopp Steel Corporation, Detroit, Mich., has approved plans for strip steel manufacturing plant reported to cost $200,000. Detroit Aircraft Corporation, Wayne, Mich., plans airplane manufacturing plant reported to cost $100,000. Mechanical Universal Joint Company, Rockford, Ill., plans addition to cost about $100,000. Illinois Steel Company, Chicago, Ill., will build a machine shop at South Chicago works to cost $260,000. International Harvester Company, Chicago, Ill., will soon begin superstructure for a factory branch and distributing plant at San Antonio, Tex., reported to cost about $100,000.

Auburn Automobile Company, Auburn, Ind., will carry out an expansion program to cost over $2,000,000. Dayton Rubber Manufacturing Company, Dayton, Ohio, contemplates a plant in the vicinity of Los Angeles, Calif., to cost more than $2,000,000. Cincinnati Engineer Tool Company, Cincinnati, Ohio, has filed plans for an addition to cost about $50,000. Elyria, Ohio, plans installation of ornamental lighting system. Proctor & Gamble Company, Cincinnati, Ohio, will build a soap-manufacturing plant at Long Beach, Calif., to cost $4,000,000. Firestone Tire & Rubber Company, Akron, Ohio, will carry out an

expansion program at plant at Los Angeles, Calif., to cost $2,500,000. Thew Shovel Company, Lorain, Ohio, plans expansion in plant to cost about $100,000.

Northern Pacific Railway Company, St. Paul, Minn., will make extensions in engine house and shops at Mandan, N. D., to cost about $80,000. St. Paul, Minn., plans ornamental lighting system in the business district. Monticello Preserving Company, Monticello, Minn., plans rebuilding of portion of plant recently destroyed by fire with loss of about $100,000. Lincoln, Neb., has authorized installation of ornamental lighting system. Fremont, Neb., plans extensions and improvements in municipal electric light and power plant to cost $60,000.

New England

While some let-down in the buying of heavy electrical equipment is apparent in New England, the trend in movement of electrical supplies is encouraging and quite normal for this time of year; projects requiring electrical equipment during the coming year are greater in number, and more extensive in size than those of 1929.

Heavy industrial equipment buying is slack; negotiations are being carried on for a number of plant changes; replacement of one steam plant with electrical equipment to cost about $100,000 is of interest; changes in control units for a number of plants are being considered; small turbo-generator units are attracting interest and according to one manufacturer gained over 20 per cent in New England for the current year as compared with last year.

Small motor sales are good; fractional-horsepower motor sales increased last week with tool and machine manufacturers placing a number of orders.

Electric heating furnaces are gaining in interest among tool manufacturers; recently two 20-kw. heat-treating type furnaces were ordered for New England delivery; small types for non-ferrous metal heating are active. Interior lighting projects are being considered, and both from the standpoint of number and size are of interest. Sales of wiring devices, house and institutional lighting equipment more than double the volume reported for last year at this time. Merchandising is active; a weekly gain of about 25 per cent over last year is reported by one prominent group of central stations. New Haven R.R. will expend over $11,000,000 for new electrical equipment which includes ten new electric locomotives. New England Power Company will spend $20,000,000 during the coming year for the extension of power development and distribution.

CONSTRUCTION PROJECTS

Maine Seaboard Paper Company, Bucksport, Me., will build a newsprint mill to cost $5,000,000. Rising Paper Company, Housatonic, Mass., will build an addition to cost about $100,000. State Board of Education, Hartford, Conn., plans trade and vocational school at Meriden, Conn., to cost $175,000. Superior Spring & Manufacturing Company, Hartford, Conn., has plans for an addition to cost $50,000.

Activities of the Trade

National "Mazda" Lamps Assume New Name

National "Mazda" lamps—long a General Electric product—now take the name of General Electric "Mazda" lamps. This change, just announced by the National Lamp Works of the General Electric Company, Cleveland, is believed by it to be a distinct asset to the lamp distributor. "The new name, which is more fully descriptive of our product, will appear on the familar blue carton of the National Lamp Works during the coming year," said J. E. Kewley, general sales manager of the National Lamp Works. It will be featured in all National Lamp Works advertising beginning with January, 1930. General Electric "Mazda" lamps will be sold by the National Lamp Works with the same selling organization and through the same channels that distributed National "Mazda" lamps. The blue carton will be retained with the new name.

Ward Leonard Now on Five-Day Week

Ward Leonard Electric Company, Mount Vernon, N. Y., has announced that the company will establish a five-day schedule immediately with no reduction in wages. According to Leonard Kebler, president, reductions of weekly working hours in the past resulted in an increased production.

Stanley Electric Tool Company Organized

The Stanley Electric Tool Company, a subsidiary of the Stanley Works, has been organized at New Britain, Conn., with a paid-in capital of $50,000. The company will manufacture the electrical equipment formerly produced by the Stanley Rule & Level Company, New Britain, and also the products of the Unishear Company and Ajax Electric Hammer Company, both of New York City.

Trumbull Electric Expands

The Trumbull Electric Manufacturing Company announces the formation of a new company, the A. G. Electric Manufacturing Company of Seattle, Wash., successor to the A. G. Manufacturing Company, in which organization the Trumbull company has obtained a controlling financial interest. A. E. Griswold is president and treasurer and W. E. Froude is secretary of the new company.

For the present there will be no change in the personnel of either the Trumbull Electric Manufacturing Company in its Pacific Coast representation or in the A. G. Electric Manufacturing Company. They will work together in an endeavor to serve the electrical industry of the Far West with safety switches, panelboards, switchboards and other accessories.

Federal Electric Award for Advertising Advance

The Federal Electric Company of Chicago will continue its policy of awarding a purse of $1,000 and a gold medal for the outstanding contribution toward electrical advertising, which for the first time last year was awarded to the Edison Electric Illuminating Company of Boston.

The award will be made at the National Electric Light Association convention in San Francisco to the utility company and the individuals in that company who will have contributed most to the advancement of electrical advertising during 1929.

Under the rules of the award only members of the National Electric Light Association are eligible to compete. The contribution may be in the form of a new use for electrical advertising or of an identification program for a company's various properties. It may be in the form of an enterprise whereby businesses throughout the country or in a particular locality are brought to a keener realization of the value of electrical advertising, or it may be in the form of an activity which makes possible better merchandising of electrical advertising. Any activity that contributes to the advancement of the electrical advertising industry is eligible for consideration.

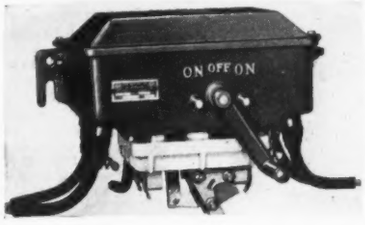
Westinghouse Electric & Manufacturing Company has appointed Thomas Fuller district manager of the southeastern territory to fill the place left vacant by the death of Henry A. Coles. A native of Charleston, S. C., and a graduate of the Georgia School of Technology, Mr. Fuller has been connected with the Westinghouse organization since 1906.

Robbins & Myers, Inc., manufacturer of motors, generators and fans, Springfield, Ohio, reports combined profits of the Ohio corporation and its subsidiary, the Robbins & Myers Company of Canada, Ltd., for the fiscal year ended August 31 netting $300,704. Provisions for estimated federal and dominion income taxes totaled $29,803, and net profits after all taxes totaled $270,901, equivalent to $1.50 per share on 100,920 shares of $25 par value preferred stock, plus approximately 95 cents per share on the 126,150 shares of no par common outstanding.

New Equipment Available

Compact, Knife-Blade Type Oil Switch

A new knife-blade type oil switch of compact design is announced by the Line Material Company, South Milwaukee, Wis. The top casting is of rugged design with bolted flanged cover, provided with gasket to make it weather-



proof. The supporting lugs at the rear provide for flat surface mounting. The leads are brought out of the housing through high-grade wet process porcelain bushings. Leads are wrapped with cord and shellacked to prevent entrance of bugs and other foreign matter. Lift rods for operating blades are ¾ in. in diameter of well-seasoned wood, especially treated to secure high dielectric strength.

The stationary contacts have milled surfaces and are provided with projections in base for locking into recesses in the white porcelain-insulated support, preventing the possibility of contacts getting out of alignment. Phosphor bronze arcing contacts of liberal width are provided for each pole. The movable contacts consist of two copper blades per pole accurately spaced. High contact pressure is secured by means of phosphor bronze cup washers on the outside of the blades. The white porcelain-insulated support is especially designed with barriers on top and below for compact arrangement of parts. This type of oil switch is provided in single and double throw and two and three pole for circuits up to 200 amp. and 4,500 volts.

Disconnect with Integral Interlocked Grounding Blade

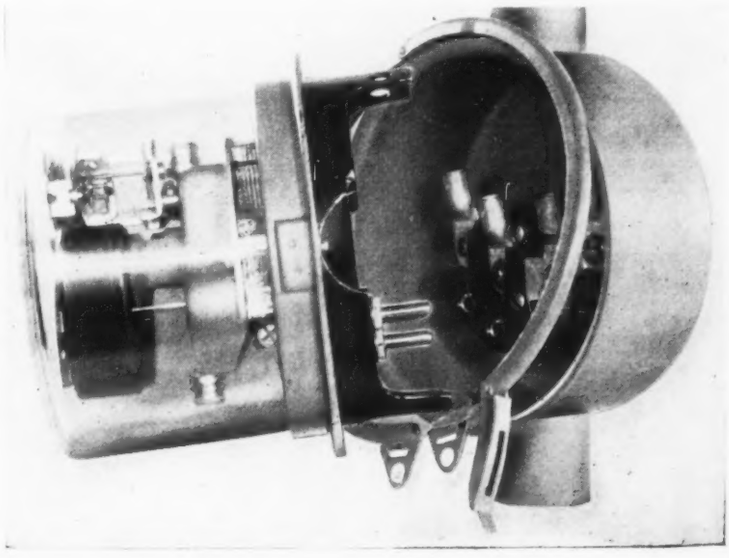
A new line of 220-kv. gang-operated vertical-break switches with grounding blades is announced by the Delta Star Electric Company of Chicago. The grounding blades of three units are interlocked and operate by means of a common handle.

The right-hand end insulator stack is mounted on ball bearings by means of levers. Three units are interconnected and operated as a gang switch. The mechanism on top of the two insulator stacks first withdraws the blade from the floating contact and then raises it to a vertical position.

Detachable Watt-Hour Meters

Detachable watt-hour meters for either indoor or outdoor service have been designed by the Westinghouse Electric & Manufacturing Company. They consist of the standard temperature compensated OB watt-hour meter housed in a weatherproof case. The following advantages are claimed:

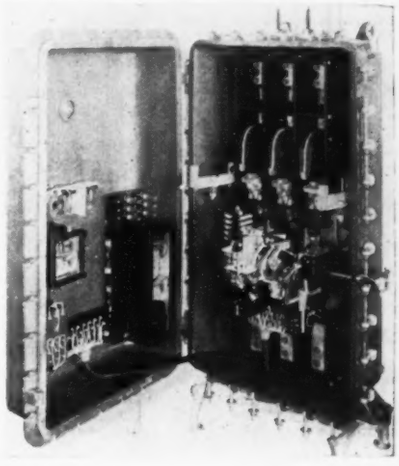
Plug terminals which make installation or removal easy; detachable meters can be plugged into place or removed in a moment like radio tubes; suitable for mounting in any location, outdoor or indoor; reduces labor, reading and testing costs; completely iron-clad and tamper proof; adjustable terminal block which permits mounting the meter with conduit entrance at top, bottom, right or left. They are particularly adaptable to modern methods of conduit wiring employed in apartment buildings.



Motor-Operated, Trip-Free Network Protectors

Two new types of motor-operated, trip-free network protectors are announced by the General Electric Company. The submersible type MG-6 is rated 800, 1,200 and 1,600 amp. The non-submersible type MG-7 is rated 800, 1,200, 1,600 and 2,000 amp.

The type MG-6 is actuated by a trip-free motor mechanism with a tripping range of from 15 to 230 volts. The breaker unit is removable without dis-



turbing the cable connections. Main contacts are of silver. The potential wiring and breaker unit can easily be isolated. Adjustable parts and wiring are readily accessible and the revolution counter and fuses, both illuminated, can be seen through glass windows in the cover of the water-tight box. The type MG-7 embodies all the features necessary to it of the MG-6 except that it is non-submersible and is not furnished in an inclosing case, according to the manufacturer.

These new network protectors are in addition to the solenoid-operated units, which are rated at 500 and 800 amp. in the submersible type and 800 and 1,200 amp. in the non-submersible type.

Self-Contained Controller for Low-Head Cranes

A new self-contained, triple drum controller with a resistor mounted on the back for the floor operation of the three motions of small, low-head cranes is announced by the General Electric Company.

The general construction is similar to that of the standard General Electric line, with rope wheel having spring return, vertical or horizontal handle all interchangeable. The horizontal handle arrangement is provided in case it is desired to install the controller in a crane cab for the usual method of manual operation. In such an installation the resistor can be separated from the drum switches, which is necessary if all three motors are rated the full 10 hp. rating of the controllers.

Electrical Patents

Announced by U. S. Patent Office

(Issued November 5, 1929)

1,734,557. AUTOMATIC GENERATING PLANT; A. F. Brotz, Kohler, Wis. App. filed Oct. 5, 1925.

1,734,565. CIRCUIT CONTINUING DEVICE; H. A. Douglas, Bronson, Mich. App. filed May 5, 1928.

1,734,594. AUXILIARY BASE FOR SIGNAL AND CABLE POSTS; J. H. Molloy, Chicago, Ill. App. filed May 2, 1927.

1,734,597. NON-SKIDDING INSULATED STOOL; M. B. Salisbury, Chicago, Ill. App. filed Jan. 9, 1928.

1,734,599. ELECTRICAL SYSTEM FOR OUTBOARD MOTORS; A. Schriel and H. J. Hillborn, Milwaukee, Wis. App. filed Dec. 30, 1926.

1,734,605. CORD TAKE-UP AND PROTECTOR; L. C. Smith, Chicago, Ill. App. filed Aug. 21, 1926.

1,734,609. THERMALLY-CONTROLLED HEATING APPARATUS; I. B. Andrews, Beverly, Mass. App. filed Feb. 13, 1926.

1,734,611. ELECTRIC BREAD TOASTER; D. L. Chandler, Boston, Mass. App. filed Dec. 14, 1927.

1,734,668. ELECTRIC SWITCH MECHANISM; C. A. Fox, Deer Lodge, Mont. App. filed April 21, 1928.

1,734,678. COMBINED NAME AND BELL BUTTON PLATE; G. H. Krogel, Troy, N. Y. App. filed Sept. 18, 1922.

1,734,692. INTERRUPTER FOR ELECTRIC CURRENT; A. Rebori, Buenos Aires, Argentina. App. filed Jan. 27, 1922.

1,734,700. COATED CORE; H. G. Walker, Berwyn, Ill. App. filed June 5, 1923.

1,734,716. APPARATUS FOR WELDING; T. A. Daniel, Maywood, Ill. App. filed April 27, 1927.

1,734,781. ALARM-CIRCUIT SYSTEM; G. C. Snyders, C. Gordyn, Jr., J. van de Kamp, and C. E. A. Maitland, Amsterdam, Netherlands. App. filed Jan. 25, 1928.

1,734,783. VACUUM-TUBE SOCKET; W. C. Stevens and G. J. Meuer, Milwaukee, Wis. App. filed Dec. 8, 1924.

1,734,809. LEADING-IN CONDUCTOR; G. Holst, J. Bergmans and C. Bol, Eindhoven, The Netherlands. App. filed May 14, 1923.

1,734,811. BRUSH FOR DYNAMO-ELECTRIC MACHINERY; W. C. Kalb, Bradford, Pa. App. filed May 19, 1925.

1,734,828. WATER HEATER; D. F. Priser, North Manchester, Ind. App. filed Dec. 15, 1928.

1,734,851. SWITCH; F. Ellis, McAndrews, Ky. App. filed Oct. 28, 1927.

1,734,874. SELECTIVE GROUND-DETECTING RELAY; S. Norberg, Valhalla, Vasteras, Sweden. App. filed June 16, 1922.

1,734,890. SYSTEM OF DISTRIBUTION; T. F. Barton, Schenectady, N. Y. App. filed Aug. 10, 1926.

1,734,892. PULL-OFF FOR TROLLEY WIRES; G. W. Bower, Schenectady, N. Y. App. filed Dec. 21, 1927.

1,734,893. MEANS FOR ADJUSTABLY SUPPORTING OUTLET BOXES; G. Carlson, Ansonia, Conn. App. filed Oct. 25, 1927.

1,734,900. LEADING-IN WIRE FOR GLASS VESSELS; E. Friederich, Berlin, Germany. App. filed Aug. 30, 1921.

1,734,902. ELECTRICALLY-WOUND CLOCK; C. I. Hall, Fort Wayne, Ind. App. filed Nov. 18, 1927.

1,734,907. BRUSH-SHIFTING DEVICE; J. I. Hull, Schenectady, N. Y. App. filed Sept. 13, 1928.

1,734,909. ELECTROPLATING TANK; C. E. Jones, Schenectady, N. Y. App. filed Oct. 15, 1925.

1,734,912. ELECTRIC SWITCH; H. W. Lyon, Erie, Pa. App. filed Nov. 5, 1927.

1,734,913. METHOD AND APPARATUS FOR ELECTRICALLY HEATING ARTICLES; H. E. Norman, Springfield, Mass. App. filed July 14, 1927.

1,734,915. MERCURY ARC RECTIFIER SYSTEM; J. C. Read, Rugby, England. App. filed Aug. 28, 1928.

1,734,916. COMBINED ELECTRICAL SWITCH AND FUSE; H. Rodin, Cleveland, O. App. filed Nov. 2, 1927.

1,734,917. ELECTRIC DISCHARGE DEVICE; F. W. Peek, Jr., Pittsfield, Mass. App. filed Dec. 27, 1928.

1,734,918. MAGNETO; W. S. Robinson, Jr., Springfield, Mass. App. filed Jan. 6, 1928.

1,734,919. MOTOR CONTROLLER; C. F. Scott, Schenectady, N. Y. App. filed Oct. 12, 1926.

1,734,925. CIRCUIT CONNECTER; G. H. Tovey, Schenectady, N. Y. App. filed May 18, 1925.

1,734,926. PIEZO ELECTRIC DEVICE; A. B. Tripp, Cliftondale, Mass. App. filed July 6, 1926.

1,734,931. INTERNAL-COMBUSTION ELECTRIC DRIVE; L. W. Webb and B. Woodward, Schenectady, N. Y. App. filed March 23, 1926.

1,734,932. WELD ROD AND METHOD OF MAKING THE SAME; J. M. Weed, Ballston Lake, N. Y. App. filed Oct. 27, 1927.

1,734,941. ELECTRICAL ACTUATING MEANS FOR CLOCKS AND OTHER INSTRUMENTS; G. P. Cowles, Brooklyn, N. Y. App. filed Jan. 5, 1928.

(Issued November 12, 1929)

1,734,955. ELECTRIC STARTER FOR INTERNAL COMBUSTION ENGINES; R. L. Aspen, Chorley, England. App. filed July 10, 1928.

1,734,971. OUTLET BOX; C. A. Johnson, Chicago, Ill. App. filed Oct. 31, 1924.

1,734,982. ELECTRIC CIRCUIT INTERRUPTER; M. M. Samuels and J. Amon, New York, N. Y. App. filed Mar. 29, 1922.

1,735,002. QUICK RESPONDING LEAKAGE RELAY; W. Gaarz and J. Sorge, Berlin-Charlottenburg, Germany. App. filed Nov. 17, 1925.

1,735,018. LIGHTING DEVICE; J. L. Smith, Buffalo, N. Y. App. filed Sept. 3, 1925.

1,735,020. TUNING COIL; R. J. J. Starr, Briercrest, Saskatchewan, Can. App. filed April 29, 1926.

1,735,023. LIQUID MEASURING DEVICE; L. R. Titcomb, Brooklyn, N. Y. App. filed Jan. 10, 1925.

1,735,039. BATTERY TERMINAL; T. Cotter and T. F. Griggs, Evansville, Ind. App. filed Feb. 18, 1927.

1,735,057. TOY STEAM ENGINE; W. Ritchie, New Bedford, Mass. App. filed Dec. 8, 1925.

1,735,072. FUSE BLOCK HOUSING; R. B. Benjamin, Chicago, Ill. App. filed Dec. 6, 1926.

1,735,092. TRANSFORMER; F. W. Roller, East Orange, N. J. App. filed Sept. 18, 1925.

1,735,088. SAFETY IRON HOLDER; R. Penner, Detroit, Mich. App. filed Mar. 14, 1927.

1,735,093. HEATER AND STERILIZER; K. K. Sikes, Tolt, Wash. App. filed April 30, 1928.

1,735,112. SWITCH; C. F. Gilchrist, Toledo, O. App. filed Feb. 26, 1921.

1,735,114. SHORT-CIRCUITING DEVICE; E. J. Haverstick, Oakmont, Pa. App. filed May 19, 1927.

1,735,116. AUTOMATIC STATION; G. F. Jones, Irwin, Pa. App. filed May 19, 1928.

1,735,131. CONDUCTOR SUPPORT; W. Schaake, Pittsburgh, Pa. App. filed Nov. 6, 1928.

1,735,133. SUPPORT FOR THERMIONIC TUBES; A. Schmidt, Berlin, Germany. App. filed Nov. 22, 1924.

1,735,141. INDUCTANCE DEVICE; O. Sturner, Berlin-Schoneberg, Germany. App. filed July 2, 1926.

1,735,163. ELECTRICAL APPARATUS; J. C. Federle, Dayton, O. App. filed Feb. 1, 1926.

1,735,165. ELECTRIC WATER HEATER; C. H. Hornby, Schenectady, N. Y. App. filed May 29, 1928.

1,735,168. TERMINAL FOR HEATING UNITS; W. R. King, Mansfield, O. App. filed Mar. 28, 1927.

1,735,179. ELECTRICAL APPARATUS; K. C. Randall, Edgewood, Pa. App. filed April 11, 1927.

1,735,184. SELECTOR SWITCH FOR ANNUNCIATOR SYSTEMS; A. Sanchez, Washington, D. C. App. filed Dec. 28, 1927.

1,735,189. SELECTIVE SIGNALING SYSTEM; S. J. Turreff, St. Louis, Mo. App. filed July 19, 1928.

1,735,196. CONDUIT FITTING; J. C. Boyton, Cleveland, O. App. filed Dec. 2, 1926.

1,735,213. METHOD OF ATTACHING FINS TO CYLINDERS; L. J. Purdy, Syracuse, N. Y. App. filed Jan. 4, 1928.

1,735,215. CURATIVE RAY GENERATOR; L. G. Schwanzel and O. A. Knisely, Toledo, O. App. filed April 3, 1928.

1,735,222. STATOR FOR ALTERNATING CURRENT MOTORS; C. F. Thompson, Oak Park, Ill. App. filed June 23, 1928.

1,735,225. THERMAL RELAY; H. E. White, Wilkinsburg, Pa. App. filed Aug. 7, 1926.

1,735,263. CONTACT MECHANISM; H. W. Cheney, Milwaukee, Wis. App. filed Oct. 29, 1919.

1,735,268. THERMOSTAT; A. E. Ellis, Boston, Mass. App. filed Feb. 8, 1923.

1,735,269. THERMOSTAT; A. E. Ellis, Long Island City, N. Y. App. filed Feb. 16, 1926.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

New Trade Literature

ASBESTOS PRODUCTS. — A new brochure entitled "Johns-Manville Service to the Electrical Industry" has recently been published by the Johns-Manville Corporation, New York. This booklet combines under one cover the three products asbestos ebony, electrobestos and transite.

MOTORS.—Louis Allis Company, Milwaukee, Wis., has just published an attractive twelve-page bulletin covering the Louis Allis type electric motor.

UNION METAL EXTERIOR LIGHTING FIXTURES.—A new catalog, A.I.A. File No. 31f23-1929, of its exterior lighting fixture line has been announced by the Union Metal Manufacturing Company, Canton, Ohio. The folder illustrates a large number of interesting designs executed both in union metal pressed steel construction and king ferronite cast iron. Union Metal has recently added a bronze foundry to its plant and is now able to reproduce any design in either bronze or cast iron.

KING FERRONITE LAMP STANDARDS.—The Union Metal Manufacturing Company, Canton, Ohio, distributor of King Company products, announces a new catalog of King "Ferronite" lamp standards, "Ornamental Street Lighting Design Book No. 101." The book contains an interesting description of "Ferronite" metal and illustrates a large number of popular King designs.

COUPLINGS. — Poole Engineering & Machine Company, Baltimore, Md., has recently compiled and published a flexible coupling handbook describing and illustrating the various types of flexible couplings manufactured by that company.

WELDING RODS. — Fusion Welding Corporation, Chicago, has issued descriptive bulletin No. 4 on type S welding rods.

CRANES AND HOISTS.—Shepard Niles Crane & Hoist Corporation has recently issued ice plant bulletin 72B, illustrating electric cranes and hoists for ice plants. This bulletin supersedes bulletins 72 and 72A.

OUTDOOR SWITCHHOUSES. — Westinghouse Outdoor Switchhouses is the title of an eight-page booklet C-1861, recently released by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The application, distinctive features, construction and advantages of outdoor switchhouses with manual, motor or solenoid-operated oil circuit breakers are given. General and equipment specifications are listed in full for each of the three different types, with a description of the automatic reclosing equipment, which is available for all electrically operated breaker equipments and is recommended for all feeder circuits. Outline dimensions and drawings of the different types of switchhouses complete the circular.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Agency is sought in Milan, Italy (No. 42,381), for electromedical apparatus.

Agency is sought in Paris, France (No. 42,383), for electromedical and surgical apparatus.

Agency is sought in Leeds, England (No. 42,484), for electric welding generators.

Agency is sought in Montreal, Canada (No. 42,380), for electrical household appliances.

Agency is sought in Paris, France (No. 42,383), for electrical household appliances.

Agency is sought in Berlin, Germany (No. 42,414), for electrical household appliances.

Agency is sought in Paris, France (No. 42,383), for electric measuring instruments.

Agency and purchase are sought in Johannesburg, South Africa (No. 42,382), for electric motors up to 50 hp.

Agency and purchase are sought in Turin, Italy (No. 42,426), for electric phonograph motors.

Purchase is sought in Santiago, Chile (No. 42,384), of power plants, 200 hp.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Power Must Come Increasingly from Fuel

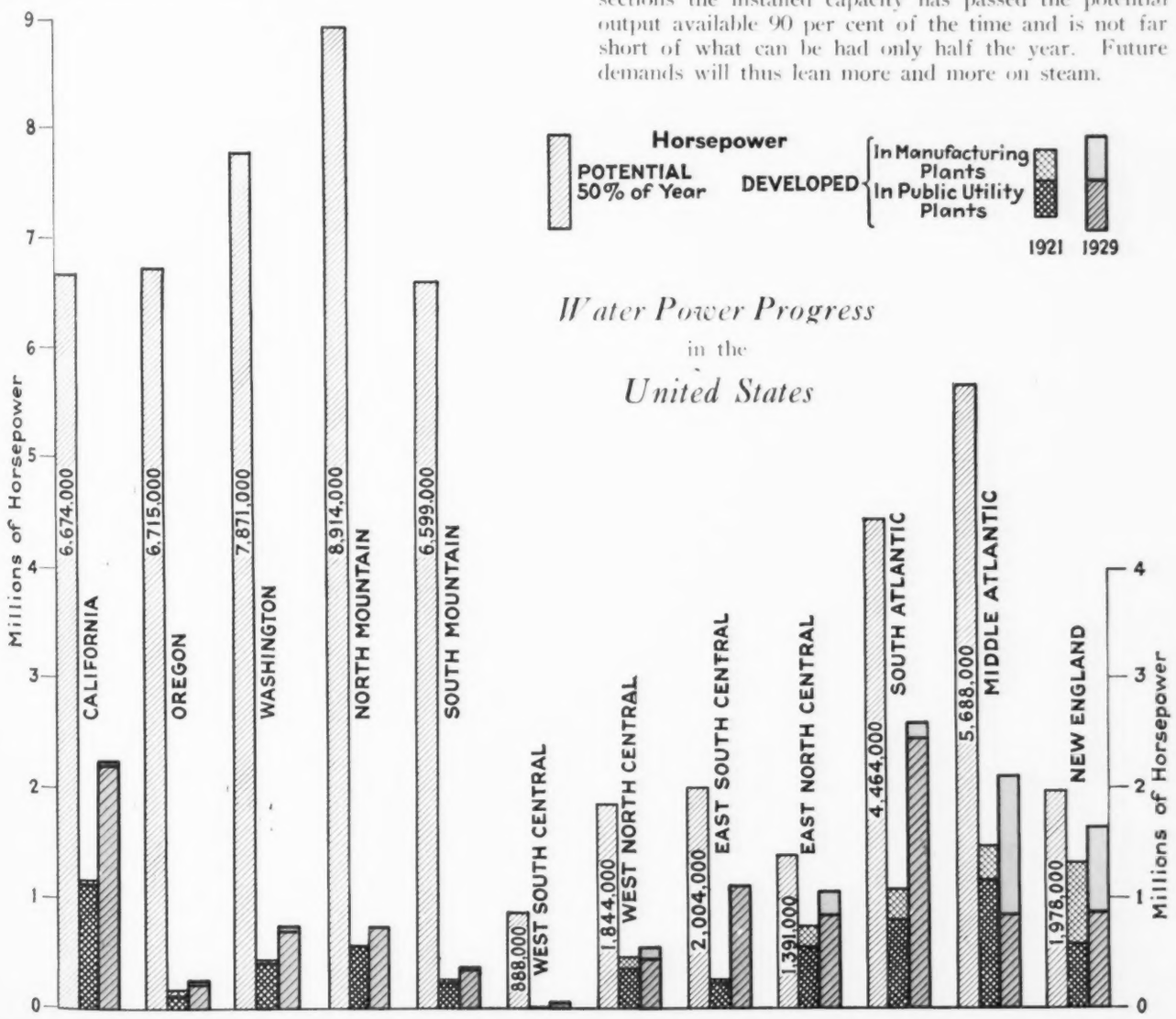
THE potential water power of the United States available 90 per cent of the time amounts to 34,818,000 hp. If all the flow available at least 50 per cent of the time is included the total comes to 55,030,000 hp. Compared with this there had been developed, at the beginning of the current year, 13,571,530 hp., of which only one-eighth was in manufacturing and miscellaneous plants, seven-eighths being operated by public utilities. Only in the East is any considerable fraction of the water power directly used by industry.

Since the actual economically justified installation at a site is often well in excess of that corresponding to the flow during 50 per cent of the year, we might seem to have gone only a short distance in making use of this important natural resource.

But analysis by geographical regions puts the matter in a different light. More than two-thirds of the country's potential water power is in the eleven Western states: close to 24,000,000 hp. on the 90 per cent basis; 36,773,000 hp. on the basis of a stream flow available half the year. Although this region includes great individual projects and its combined installations, totaling 4,403,000 hp., comprise nearly a third of the whole, it remains the area of greatest undeveloped potentialities.

Unfortunately for its early utilization, the country's center of population is 1,000 or 1,500 miles to the east, in Indiana, far beyond the present range of feasible electric power transmission.

Other than in the West the margin between developed and undeveloped power is much smaller. In some sections the installed capacity has passed the potential output available 90 per cent of the time and is not far short of what can be had only half the year. Future demands will thus lean more and more on steam.



Western Manufacturing Under Last Year

REPORTS on the consumption of electrical energy by manufacturing plants located in the Western states indicate that manufacturing during October was on a plane slightly below that at this time last year. The October rate of activity was 6.5 per cent under September and 0.7 per cent under October last year. The drop in rate of activity from September to October was very close to that witnessed during the same period last year. The average rate of operations of these plants during the first ten months of the year was 12 per cent above the same period last year.

Nationally, manufacturing appears to be maintained on a slightly higher plane than in the Western states. The October rate of operations in the nation as a whole was 0.9 per cent under September, but was 3.9 per cent above October, 1928.

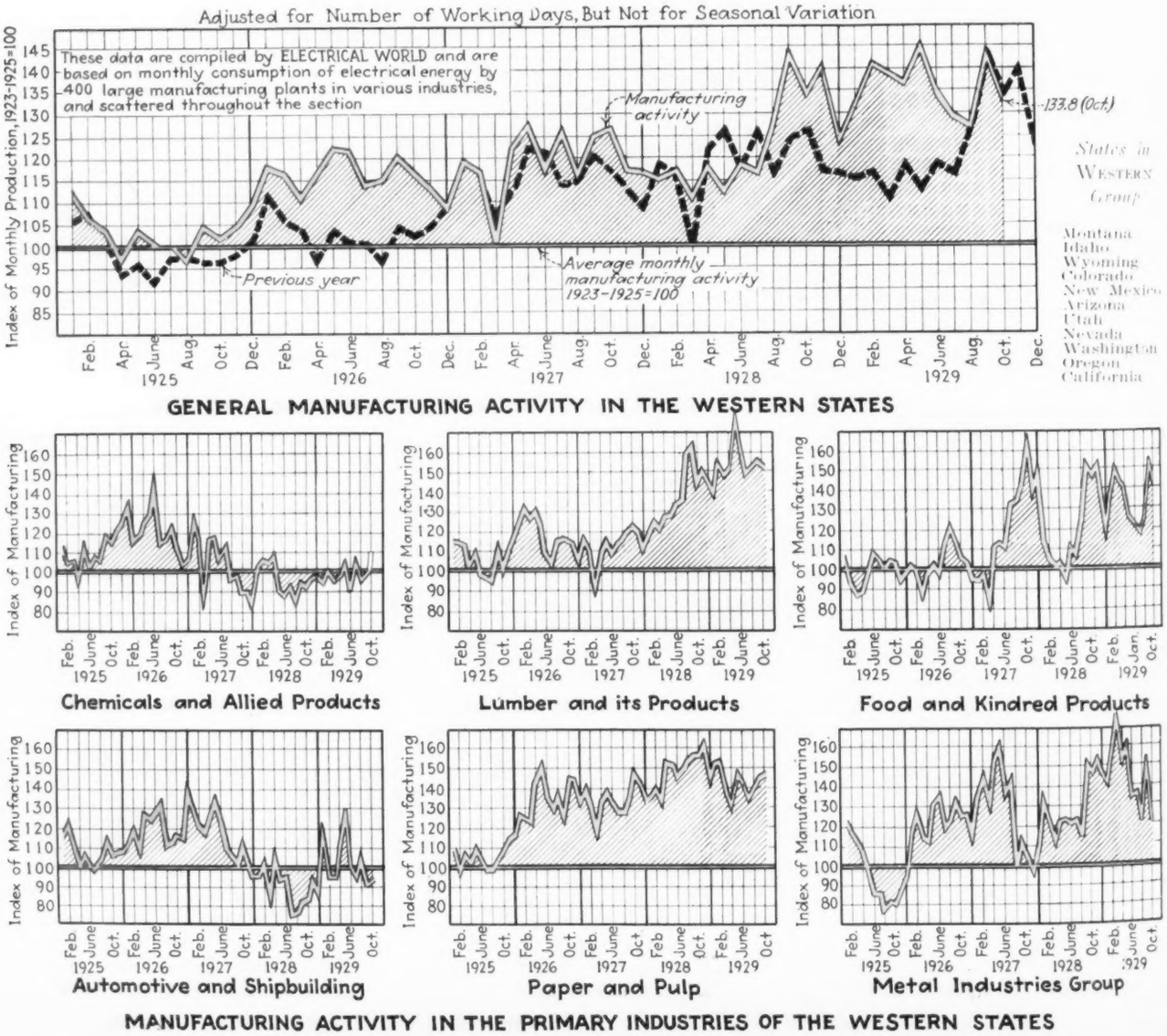
Indexes of Industrial Activity in the Western States

(All figures adjusted for number of working days)

	October, 1929	September, 1929	October, 1928	Average First Ten Months 1929	Average First Ten Months 1928
All industry	133.8	143.1	134.8	136.0	121.5
Chemical and allied products	109.0	99.3	92.8	98.9	96.5
Food and kindred products	141.5	153.0	146.0	135.5	116.5
Metals group	120.2	151.4	148.7	149.4	129.2
Forest products	152.2	153.6	144.5	153.8	135.5
Paper and pulp	147.2	146.4	156.8	142.4	146.4
Rubber products	154.8	147.7	183.5	182.9	154.2
Shipbuilding	92.8	91.3	83.0	102.6	89.1
Stone, clay and glass	138.8	157.0	124.8	141.2	142.0

A study of the various industrial groups operating in the Western states indicates a wide variation in trend. Four of the leading manufacturing groups report increases over October last year, chemical products leading with 17.4 per cent, followed by shipbuilding with a gain of 11.8 per cent, stone, clay and glass 11.3 per cent and lumber products 5.4 per cent. On the other hand, four equally important manufacturing groups of the West report an October rate of activity under that of October last year, the metals group leading the curtailment with a drop in productive activity of 19 per cent, followed by rubber products with a drop of 15.7 per cent, paper and pulp 6.1 per cent and food products reporting a drop of 4.3 per cent under October, 1928.

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*


Adjusted for Number of Working Days, But Not for Seasonal Variation
Index of Monthly Production, 1923-1925=100
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Manufacturing activity
133.8 (Oct.)
Previous year
Average monthly manufacturing activity 1923-1925=100
States in Western Group
Montana
Idaho
Wyoming
Colorado
New Mexico
Arizona
Utah
Nevada
Washington
Oregon
California
GENERAL MANUFACTURING ACTIVITY IN THE WESTERN STATES
Index of Manufacturing
Chemicals and Allied Products
Lumber and its Products
Food and Kindred Products
Automotive and Shipbuilding
Paper and Pulp
Metal Industries Group
MANUFACTURING ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES